AS-i 2.1 **DP V0 and DP V1**

AS-i/PROFIBUS Gateways

User Manual

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1 The Symbols Used

Warning

This symbol warns the user of possible danger. Not following this warning can lead to personal injury or death and/or destruction of the equipment.

Attention

This symbol warns the user of a possible failure. Not following this warning can lead to total failure of the device or any other connected equipment.

Note

This symbol draws the user's attention to important information.

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2 Safety

2.1 Intended Use

Warning

The protection of operating personnel and the system against possible danger is not guaranteed if the control interface unit is not operated in accordance with its intended use.
The device may only be operated by appropriately qualified personnel in accordance with this operating manual.

2.2 General Safety Information

Warning

Safety and correct functioning of the device cannot be guaranteed if any operation other than that described in this operation manual is performed.
Connecting the equipment and any maintenance work to be carried out with voltage applied to the equipment must exclusively be performed by appropriately qualified electrotechnical personnel.
In case a failure cannot be repaired, the device must be taken out of operation and kept from inadvertently being put back into operation. Repair work is to be carried out by the manufacturer only. Additions or modifications to the equipment are not allowed and will void the warranty.

Note

The operator is responsible for the observance of local safety standards.

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3 General Information

This operating instruction holds for the following devices of the Murrelektronik GmbH:

- AS-i/PROFIBUS gateway in stainless steel housing - 1 master
  Article No. 556612
- AS-i/PROFIBUS gateway in stainless steel housing - 2 master
  Article No. 556616

The AS-i/PROFIBUS gateways already fulfill to connect AS-Interface systems to the PROFIBUS. They act as a master for the AS-Interface and as a slave for the PROFIBUS.

New AS-i Specification 2.1

The AS-i/PROFIBUS gateways already fulfil the new AS-i Specification 2.1. This means:

- Up to 62 AS-Interface slaves can be connected per AS-i network
- The transfer of analog signals via AS-i is integrated in the masters
- All further functions of the new specification, e.g. the diagnosis of the AS-i peripheral fault, are implemented.

All AS-i functions are provided as well cyclically as acyclically via PROFIBUS DP V1.

In the cyclic data transfer optionally up to 32 bytes I/O data are beeing transferred for the binary data of one AS-i network. Aditionally, analog signals and all further commands of the new AS-i specification can be transferred in the management channel via PROFIBUS.

Advanced Diagnostics

Diagnostics, which go far beyond the standard diagnostics, facilitate the simple detection of occassionally occuring configuration errors and further irritations influencing the AS-i communication. In case of an error, the down time of machines can be minimized or preventive maintenance can be initiated.

Commissioning and monitoring

The AS-i/PROFIBUS gateways can be commissioned or programmed with the help of the software "AS-i Control Tools" in combination with the PROFIBUS DP master simulator. The GSD file is included in the package.

Commissioning, debugging and setting up the AS-i parameters without the software can only be accomplished by directly using the system's push-buttons, the display and the LEDs.

Accessories:

Software "AS-i Control Tools" (Article no. 55717)

PROFIBUS DP master simulator (Article no. 556617)

PS2/Sub-D data cable for AS-i Control Tools (Part Nr. 556617)

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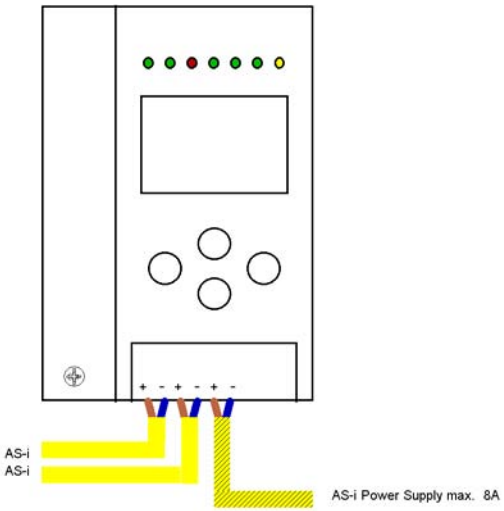
4 Connections, Displays and Operating Keys of the Gateways in Stainless Steel Housing

Devices in stainless steel housing:

On the front panel of the device in stainless steel housing are located:

- Terminals to connect the power supply and the AS-i circuit
- A 9 pin SUB-D connector as PROFIBUS interface
- 7 LEDs
- A LC display
- 4 push-buttons to configure the device

4.1 Connections of the AS-i/PROFIBUS Gateway Art. No. 566512 (Single Gateway)



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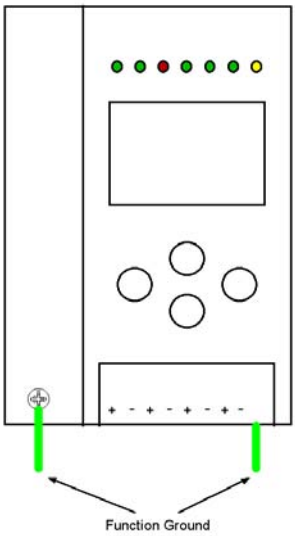
Note

It is not allowed to connect slaves or repeaters to the hatched marked cable.

Note

It is not allowed to connect AS-i power supplies or another master to the yellow marked cable.



Note

The function ground can be connected either at the ground screw or at the terminal.
The function ground should be connected with a cable as short as possible to guarantee a good EMC property.
Therefore is to prefer to connect the ground via the ground screw.

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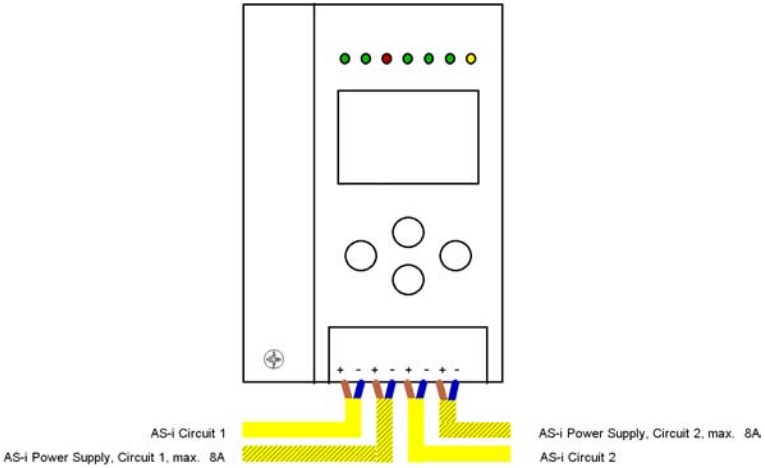
4.2 Connections of the AS-i/PROFIBUS Gateway Art. No. 566516 (Double Gateway)



Note

AS-i circuit 1 and 2 are powered by seperate power supplies.

Note

It is not allowed to connect slaves or repeaters to the hatched marked cable.

Note

It is not allowed to connect AS-i power supplies or another master to the yellow marked cable.

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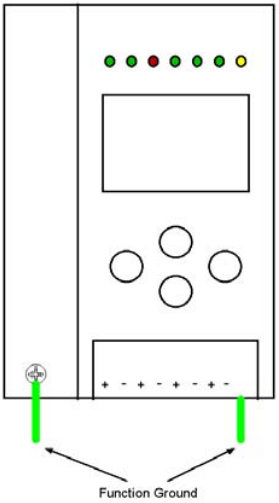
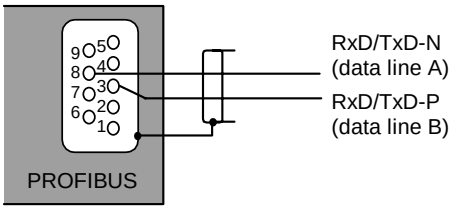


Note

The function ground can be connected either at the ground screw or at the terminal.
The function ground should be connected with a cable as short as possible to guarantee a good EMC property.
Therefore is to prefer to connect the ground via the ground screw.

4.3 The PROFIBUS Interface

The PROFIBUS interface is realized as a 9-pin SUB-D connector, in accordance to the standard for PROFIBUS DIN 19245. It is placed on the right hand side of the front panel.



The AS-i/PROFIBUS gateway sends and receives on pins 3 and 8 of the SUB-D socket. The PROFIBUS signal “RxD/TxD-N (data line A)[1]” is located on pin 8, the signal “RxD/TxD-P (data line B)[1]” is located on pin 3.

The pins 5 (0 V) and 6 (5 V) supply 5 V DC for the bus termination.

1. If you measure the DC voltage between RxD/TxD-P (data line B) and RxD/TxD-N (data line A), RxD/TxD-P (data line B) is the positive pole when the bus is silent.

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4.3.1 Bus Termination

If the AS-i/PROFIBUS gateway is at the end of the PROFIBUS line, the termination resistors in the PROFIBUS connector have to be switched on.

4.4 Display and Operating Elements

4.4.1 LEDs of the Masters

On the front panel of the AS-i/PROFIBUS gateways there are seven light-emitting diodes. The meaning of them are as follow:

Power	The master's power supply is sufficient.
Profibus	LED on: Gateway is allocated to a PROFIBUS master. LED off: Gateway is not allocated to a PROFIBUS master.
Config err	Configuration error: At least one configured slave is missing, at least one detected slave is not projected or for at least one projected and detected slave the actual configuration data does not match the nominal configuration data. This LED flashes if there is at least one periphery fault at one AS-i slave in the AS-i network. If there are configuration errors as well as periphery faults, only configuration error is displayed.
U AS-i	The AS-i circuit is sufficiently powered.
AS-i active	Normal operation active. (Flashes, if a B slave is displayed)
prg enable	Automatic address programming enabled. Exactly one slave is missing in protected operating mode. The slave can be replaced by another slave of the same type with address zero. The master addresses the new slave to the faulty address and thus eliminates the configuration error.
prj mode	The AS-i master is in configuration mode.

4.4.2 Push-Buttons

The push-buttons cause the following:

Mode/⇑	Switching between configuration mode and protected operating mode and saving the current AS-i configuration as the nominal configuration.
Set/⇓	Selecting and assigning the address to a slave.
OK, ESC	Changing to graphical mode (see chapter 5).

The detailed operation is described in chapter 5f.

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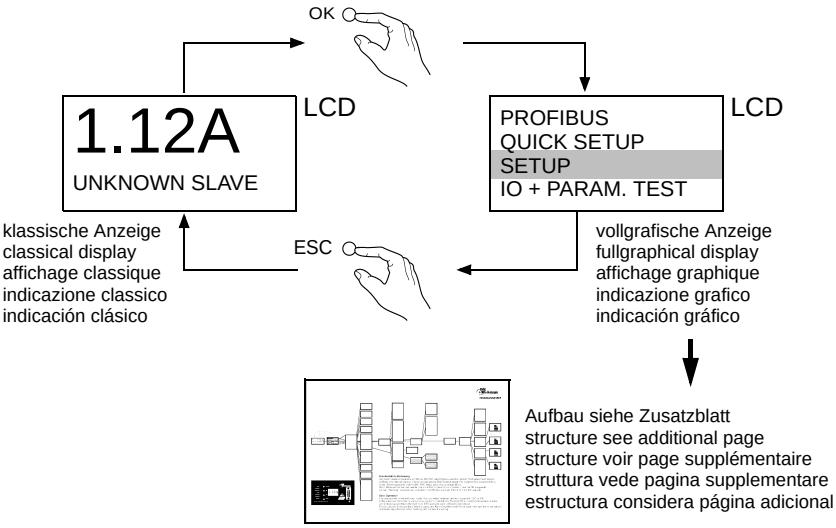
5 Commissioning of the AS-i/PROFIBUS Gateways

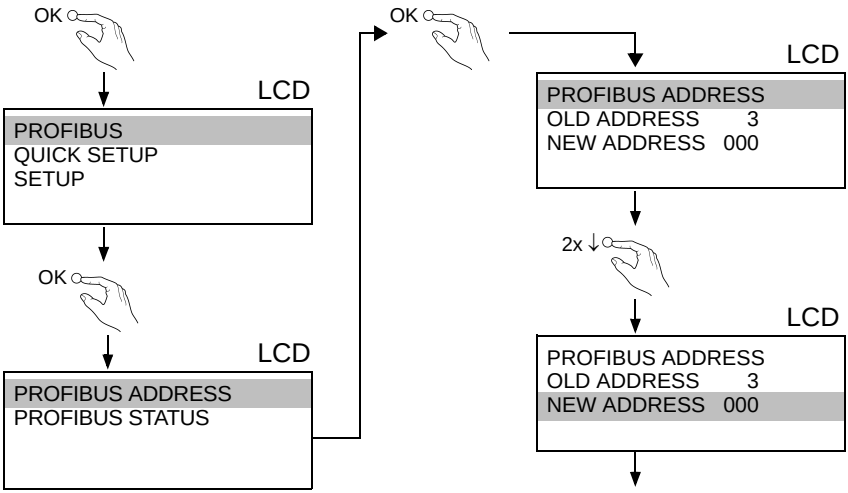
5.1 AS-i/PROFIBUS Gateway Art. No. 556612

5.1.1 Commissioning

5.1.1.1 Fullgraphic Display



5.1.1.2 Setting the PROFIBUS DP Address



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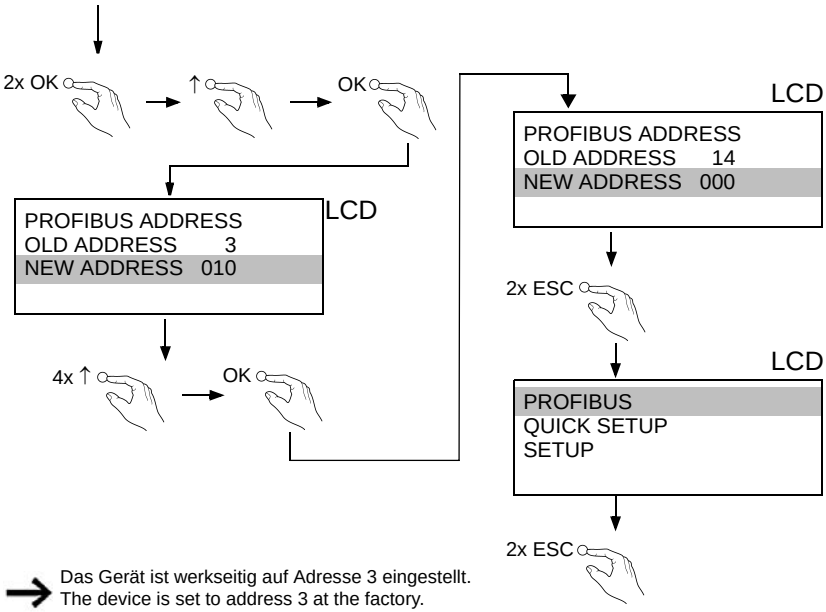
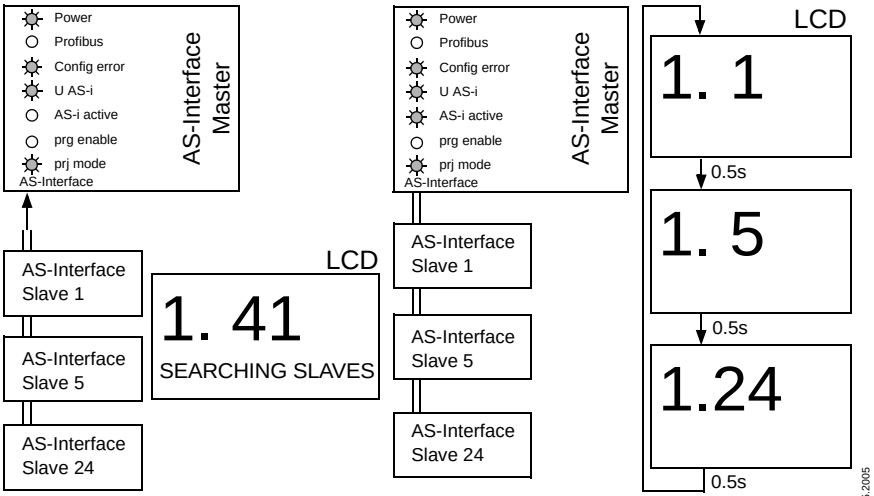


Das Gerät ist werkseitig auf Adresse 3 eingestellt.
The device is set to address 3 at the factory.
L'appareil est réglé en usine à l'adresse 3.
Il dispositivo viene de la fábrica con l'indirizzo 3.
El aparato viene ajustado de fábrica en la dirección 3.

5.1.1.3 Connecting AS-i Slaves



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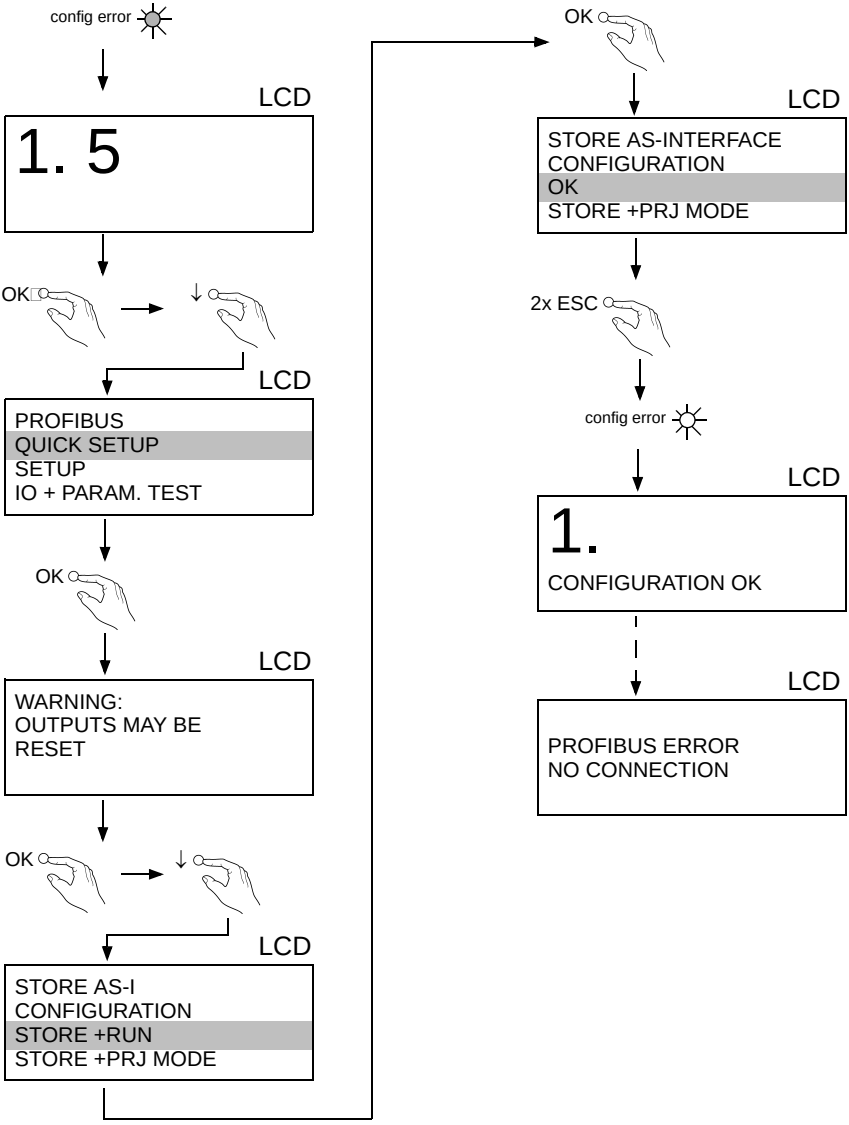
5.1.1.4 Quick Setup



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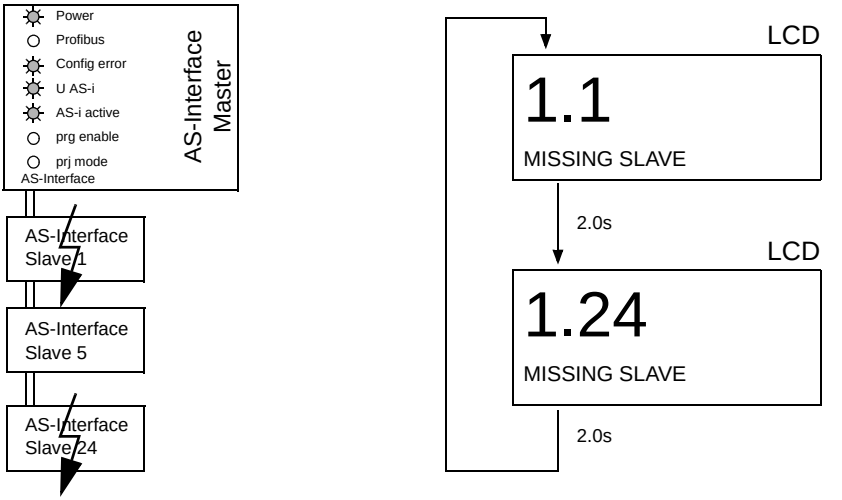
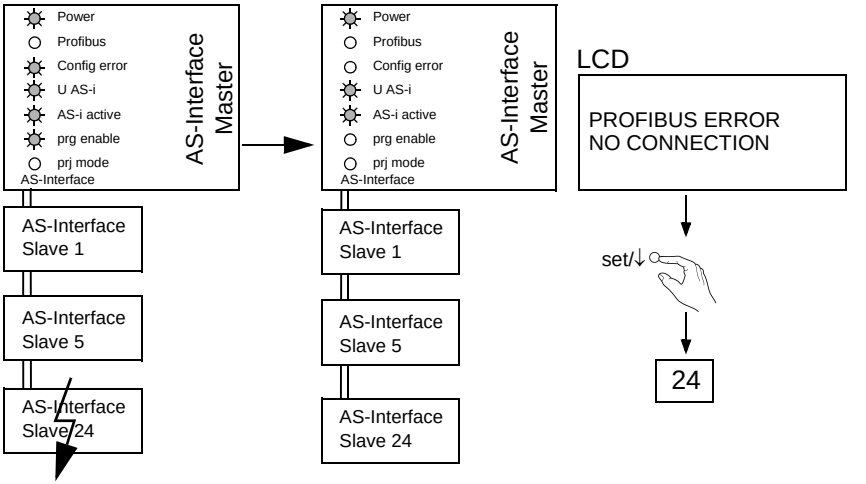
5.1.2 Error Tracing

5.1.2.1 Incorrect Slaves



5.1.2.2 Error Display (Last Error)



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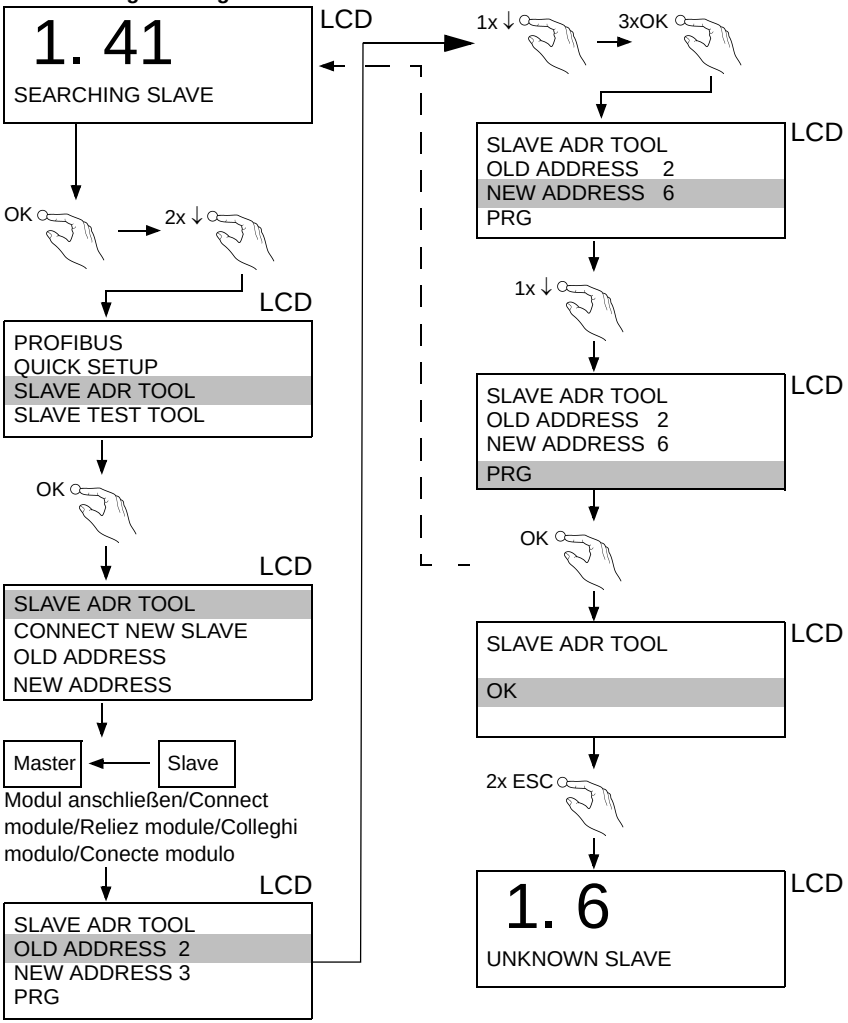
5.1.3 Addressing

5.1.3.1 Programming Slave 2 to Address 6



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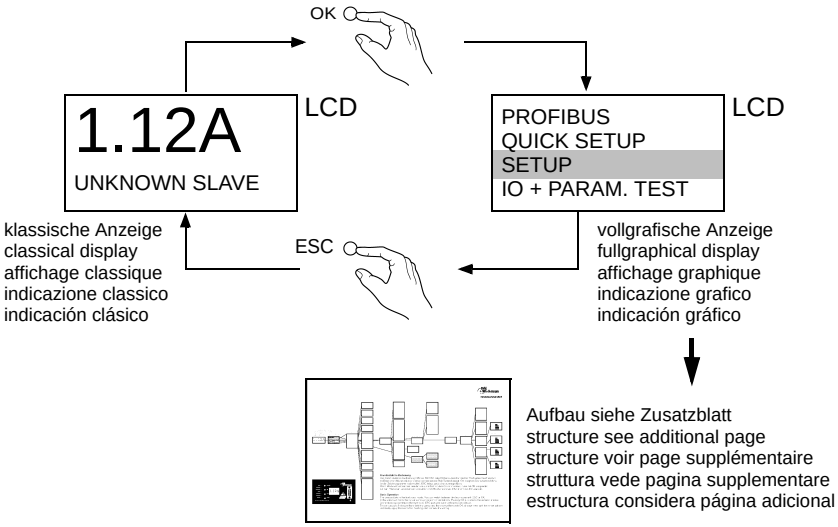
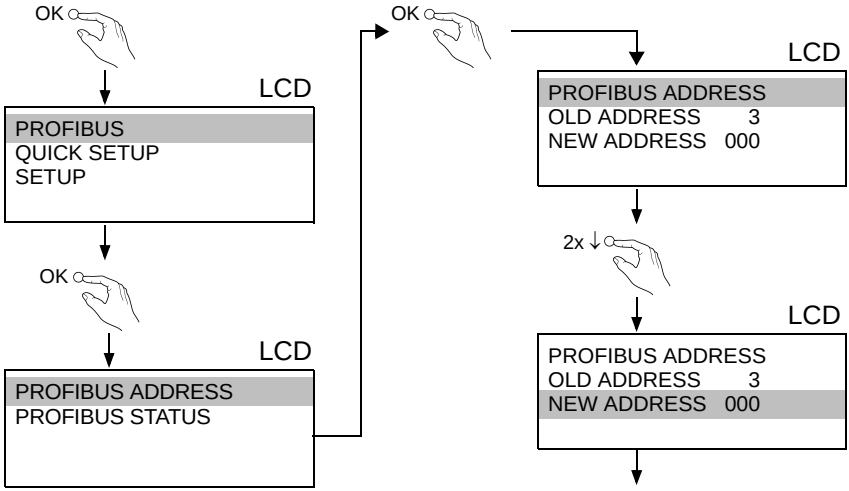
5.2 AS-i/PROFIBUS Gateway Art. No. 556616

5.2.1 Commissioning

5.2.1.1 Fullgraphic Display



5.2.1.2 Setting the PROFIBUS DP Address



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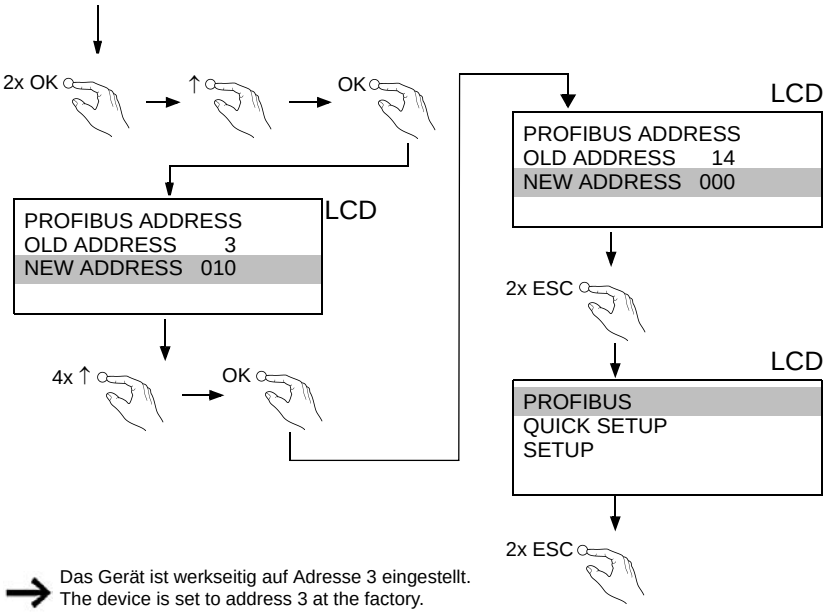
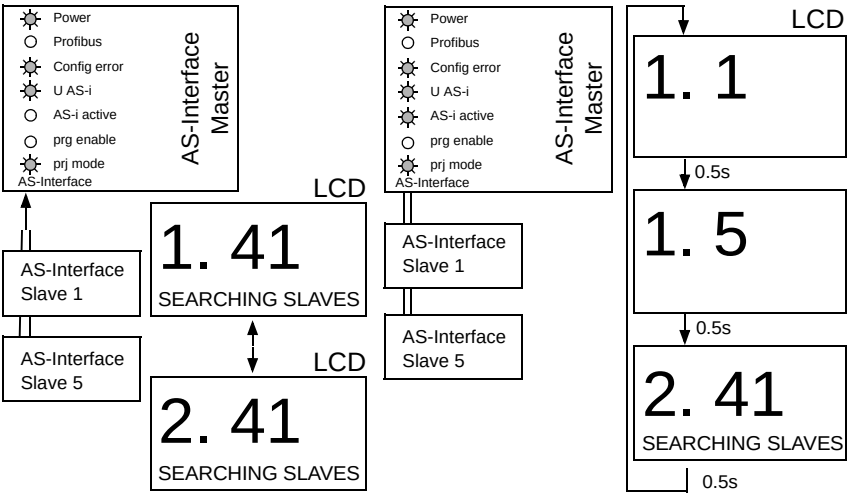


Das Gerät ist werkseitig auf Adresse 3 eingestellt.
The device is set to address 3 at the factory.
L'appareil est réglé en usine à l'adresse 3.
Il dispositivo viene de la fábrica con l'indirizzo 3.
El aparato viene ajustado de fábrica en la dirección 3.

5.2.1.3 Connecting AS-i Slaves



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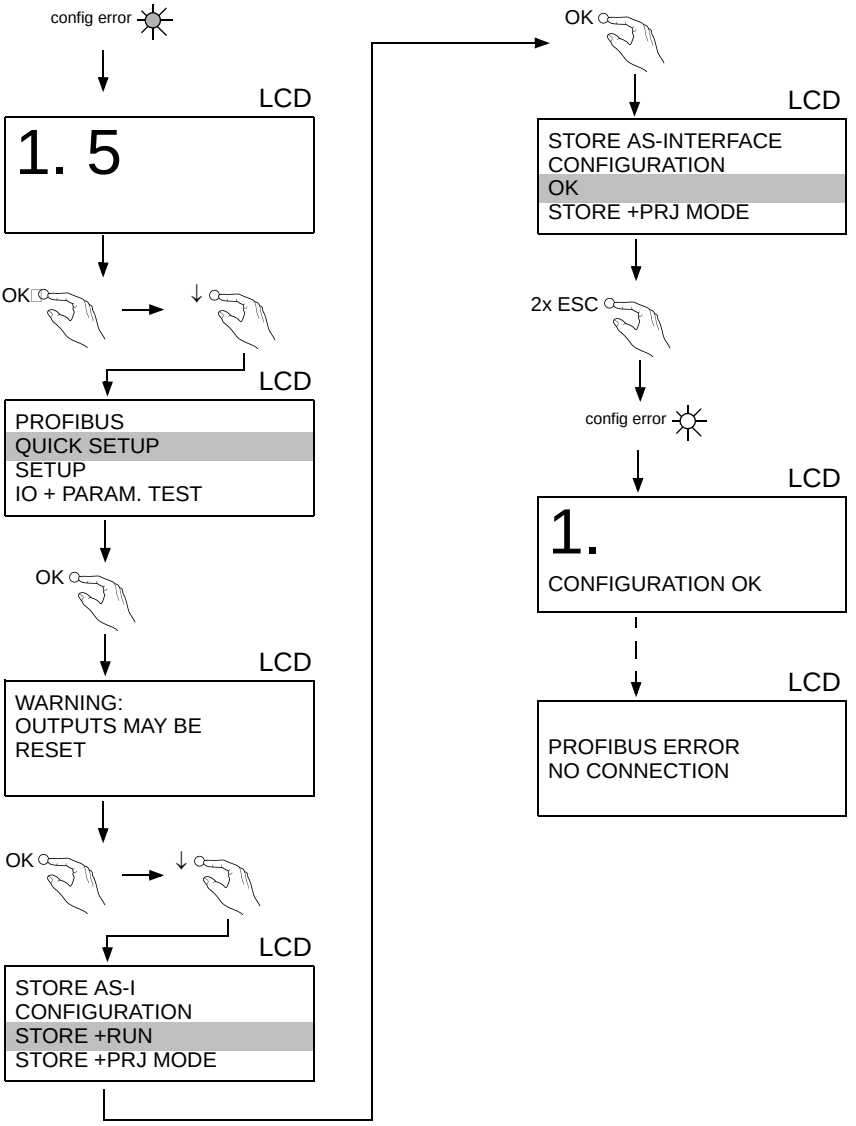
5.2.1.4 Quick Setup



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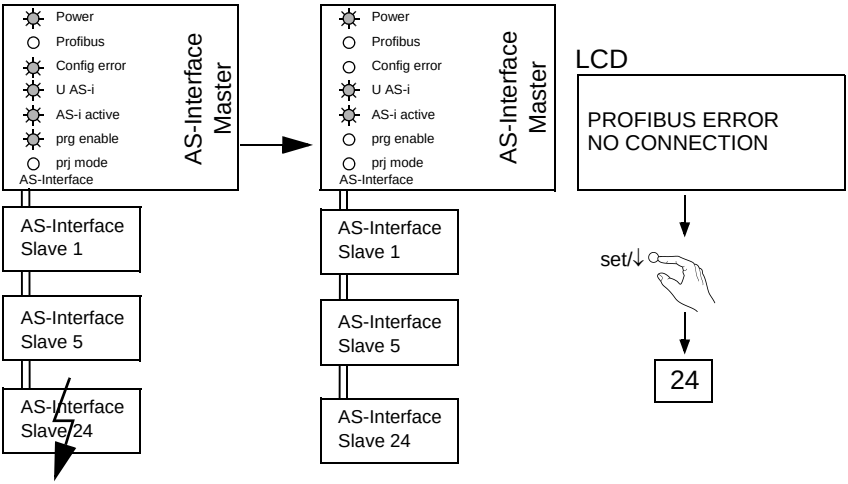
5.2.2 Error Tracing

5.2.2.1 Incorrect Slaves

5.2.2.2 Error Display (Last Error)



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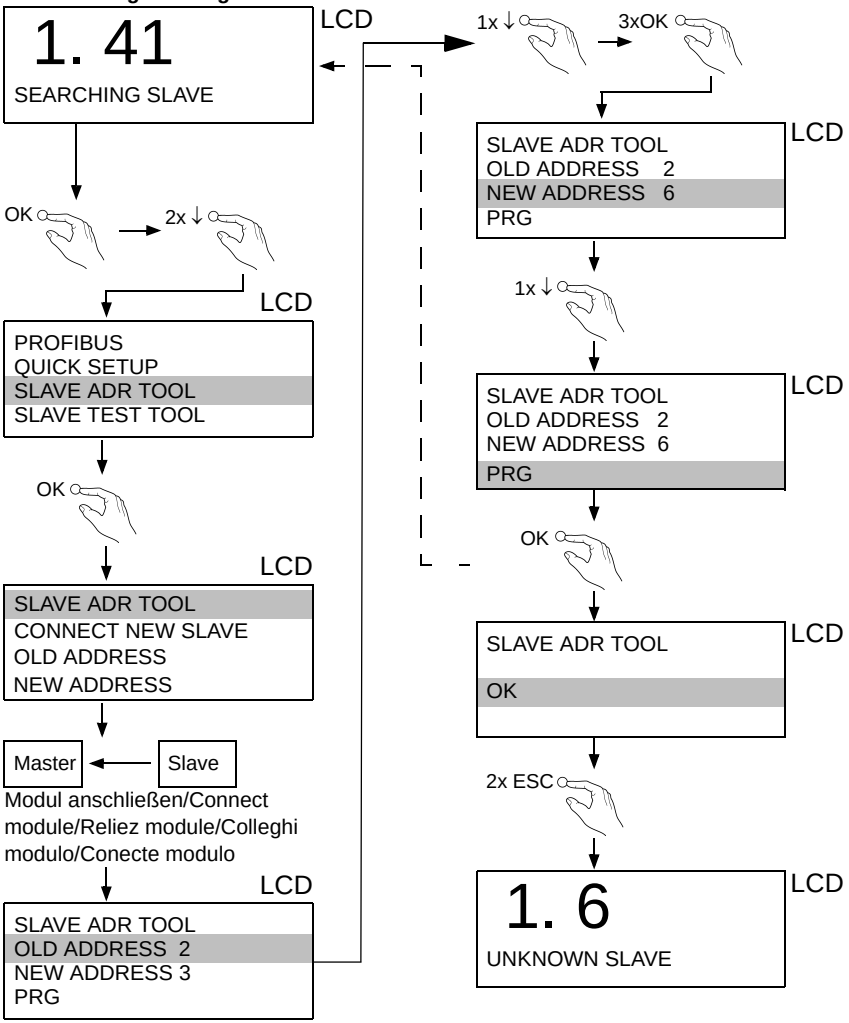
5.2.3 Addressing

5.2.3.1 Programming Slave 2 to Address 6



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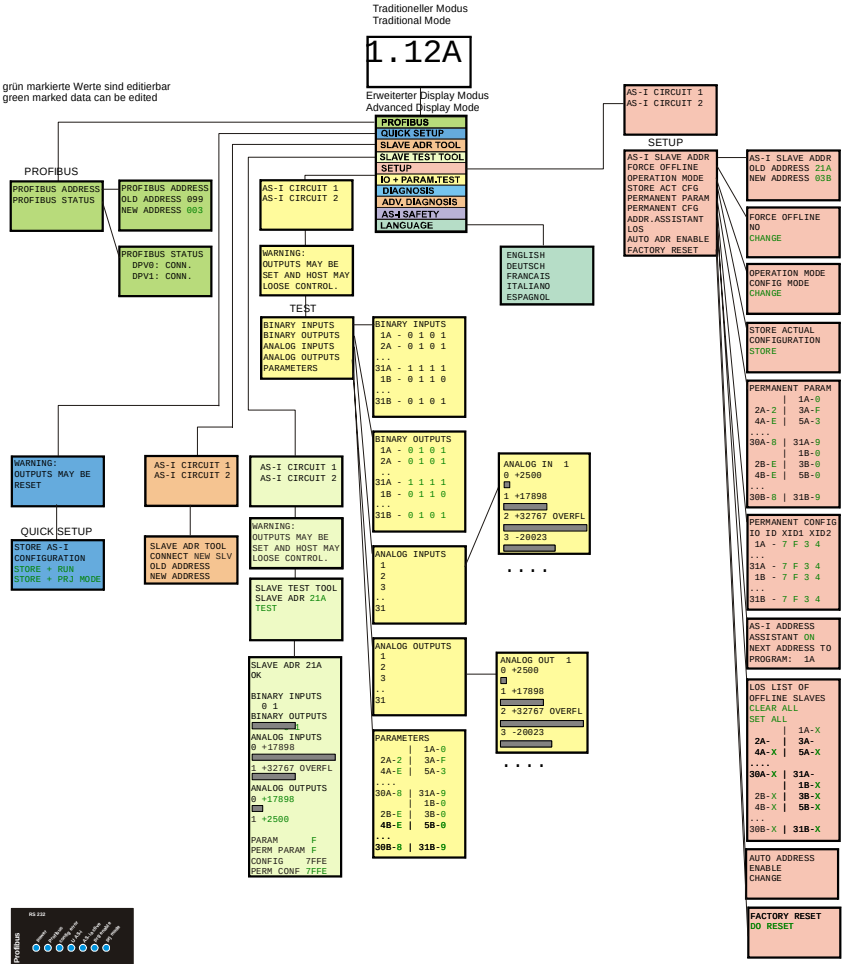
6 Operating by Fullgraphic Display

Inbetriebnahme/Commissioning



Grundsätzliche Bedienung
Das Gerät startet im traditionellen Modus. Mit ESC oder OK kann zwischen beiden Modi gewechselt werden. Im Erweiterten Modus wird ein Cursor mit den beiden Pfeil-Tasten bewegt. OK bringt ins nächsthöhere Menü (in der Zeichnung weiter nach rechts). ESC bringt zurück ins vorherige Menü.
Wenn Werte editiert werden, werden sie zunächst mit dem Cursor markiert, dann mit OK ausgewählt, mit den Pfeiltasten verändert und schließlich mit OK übernommen. ESC bricht das Editieren ab.

Basic Operation
The device starts in the traditional mode. You can switch between the two modes with ESC or OK.
In the advanced mode the cursor is moved by both arrow buttons. Pushing OK puts you to the superior menue (in the drawing one step to the right side). ESC puts you back to the previous menue.
To edit data you first mark them with the cursor and then select them with OK, change them with the arrow buttons and finally apply them with OK. Pushing ESC cancels the editing.

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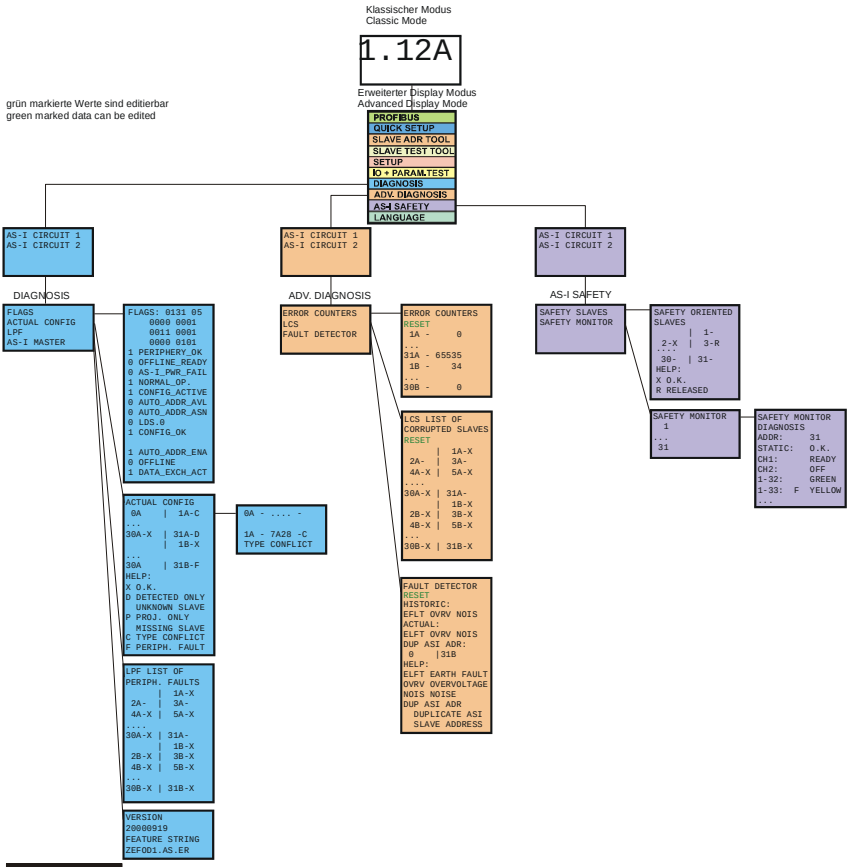
Fehlersuche/Diagnostics



Grundsätzliche Bedienung
Das Gerät startet im traditionellen Modus. Mit ESC oder OK kann zwischen beiden Modi gewechselt werden.
Im Erweiterten Modus wird ein Cursor mit den beiden Pfeil-Tasten bewegt. OK bringt ins nächsthöhere Menü (in der Zeichnung weiter nach rechts). ESC bringt zurück ins vorherige Menü.
Wenn Werte editiert werden, werden sie zunächst mit dem Cursor markiert, dann mit OK ausgewählt, mit den Pfeiltasten verändert und schließlich mit OK übernommen. ESC bricht das Editieren ab.

Basic Operation
The device starts in the traditional mode. You can switch between the two modes with ESC or OK.
In the advanced mode the cursor is moved by both arrow buttons. Pushing OK puts you to the superior menue (in the drawing one step to the right side). ESC puts you back to the previous menue.
To edit data you first mark them with the cursor and then select them with OK, change them with the arrow buttons and finally apply them with OK. Pushing ESC cancels the editing.

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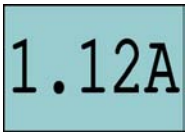
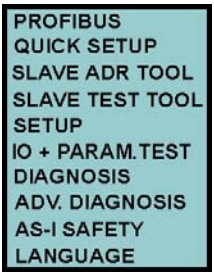
Warning

In the classical mode, it is possible to change settings while the device is in operation. This can lead to failure of the plant (e. g. changing the address of an AS-i slave).

In the fullgraphic mode, however, the settings are protected, as long as the superior fieldbus (PROFIBUS) is running.





The device starts in the classical mode, like the former AS-i Masters with two-digit display. Press the buttons ESC or OK to switch to the fullgraphic mode. To return to the classical mode, simply press the ESC-button several times.

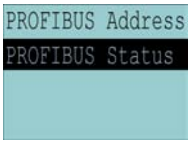
In fullgraphic mode, the selection can be moved up and down with the arrow buttons.

Pressing OK will switch to the selected function or menu (one step to the right on the drawing, page 25). Pressing ESC will switch back to the previous menu.

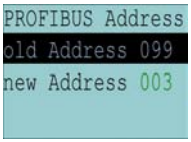
To edit data values highlight them with the selection bar, press OK, then change them with the arrow-buttons and confirm with OK. The ESC-button cancels the editing process.

All possible addresses are displayed one after the other from 1A to 31A and from 1B to 31B. Data for single slaves are displayed at the addresses 1A - 31A.

6.1 PROFIBUS (Fieldbus Interface)



6.1.1 PROFIBUS Address (PROFIBUS Station Address)



This function is for setting and changing the PROFIBUS station address.

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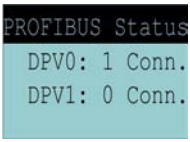
The number behind "Old Address" shows the actual station address. By selecting "New Address", this address can be changed.

6.1.2 PROFIBUS Status



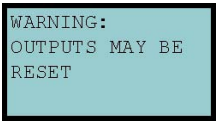
The function PROFIBUS status indicates if and how many connections are active on each PROFIBUS channel.

DPV0 = cyclic channel:
0: not active
1: active

DPV1 = acyclic channel:
0: not active
≠0: number of connections

6.2 Quick Setup

With this function you switch into configuration mode and store the actual configuration. Then the master is started in the protected mode.



To carry out the quick setup choose the menu "Store+Run". Now the actual configuration of the AS-i circuit and the connected slaves will be read.

To store the actual read configuration choose the menu "Store+Run" and confirm the selection with the OK button.

Then in the display the submenu "Store AS-Interface Configuration" will appear. By pressing "OK" the take over and the storing of the configuration is confirmed.

By pressing the ESC button twice you will leave the configuration mode and the master switches to the protected mode.

If an error occurs while storing the configuration, the following error message is displayed:

PROFIBUS Errors
No Connection

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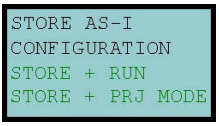
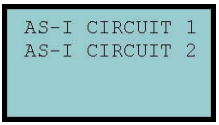
By pressing the ESC button you leave this menu and change back to the main menu. By selecting "Store + Prj Mode" you set the master in the protected mode. Now you can solve errors with the help of the diagnosis and configuration.



6.3 Slave Adr Tool (Slave Addressing Tool)

This function sets and changes the addresses of both new and configured AS-i slaves. This function replaces the handheld AS-i address programming device.



Please note that you must have selected the desired AS-i circuit usingf the arrow and the OK button when you operate a device with two AS-i circuits (see chapter 6.5.1).

Now the new slave can be connected to the AS-i circuit. After connecting the actual address of the slave is displayed by "OLD ADDRESS".and the notice "CONNECT NEW SLV" disappears.

To give the slave a new address choose the menu entry "NEW ADDRESS". Afterwards the address can be selected with the help of the arrow buttons.The (re-) addressing is carried out by selecting the menu entry "PRG" and pressing the OK button.

If an error occurs while addressing a slave, one of the following error messages is displayed for about 2 seconds:

- Failed: SND: slave with old address has not been detected.
- Failed: SD0: slave with address zero has been detected.
- Failed: SD2: slave with new address has been detected.
- Failed: DE: could not delete old address.
- Failed: SE: error setting new address.

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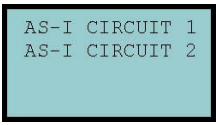
Failed: AT: new address could be stored temporarily only.
Failed: RE: error reading the extended ID-code 1.

6.4 Slave Test Tool

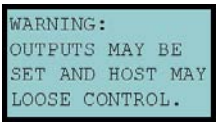
With this function a single AS-i slave can be tested.

Please note that you must have selected the desired AS-i circuit using the arrow and the OK button when you operate a device with two AS-i circuits (see chapter 6.5.1)



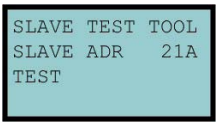
Now a warning message is displayed, that possibly by this test outputs are set and the host may loose control of the circuit.

To start the test press the OK button, to cancel press the button ESC.



In the following menu the slave to be tested has to to be chosen by selecting the slave address.

Afterwards the test is started by confirming the menu entry "Test".



After finishing the test all relevant informations is displayed for the tested slave. A successful test is displayed with "OK" below the address of the tested slave.

The following information are displayed:

- Address of the tested slave
- Test is successful/not successful
- Binary inputs (digital inputs), see also “Binary Input“, chapter 6.6.3
- Binary outputs (digital outputs), see also “Binary Outputs“, chapter 6.6.4
- Analog inputs, see also “Analog Inputs“, chapter 6.6.5
- Analog outputs, see also “Analog Outputs“, chapter 6.6.6
- Param (actual parameters), see also “Parameter“, chapter 6.6.7
- Perm Param (projected parameters), see also “Permanent Param (Projected Parameter)“, chapter 6.5.7

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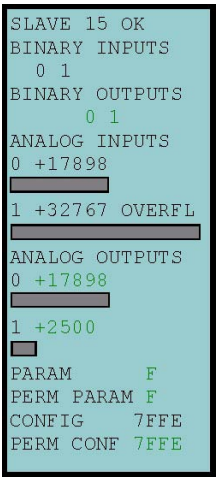
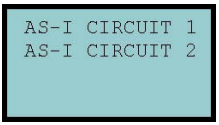
- Config (actual configuration), see also “Actual Config (Actual Configuration)“, chapter 6.7.4
- Perm Conf (projected configuration), see also “Permanent Config (Projected Configuration Data)“, chapter 6.5.8



6.5 Setup (Configuration of the AS-i Circuit)

6.5.1 AS-i Circuit



To reach this setup menu you have to change the desired AS-i circuit by using the arrow and the OK buttons.

The function is only implemented in the double master.

It makes possible to change the AS-i circuit that is currently active for being operated.

The active circuit is marked by the cursor.

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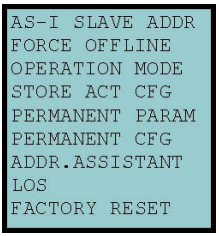
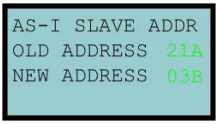
6.5.2 Setup (Configuration of the AS-i Circuit)



Within the menu "Setup", one of the following submenues can be chosen:

- AS-i Slave Addr (AS-i Slave Address)
- Force Offline (switch AS-i Master offline)
- Operation Mode
- Store Act Cfg (store actual detected configuration)
- Permanent Param (projected parameter)
- Permanent Cfg (projected configuration data)
- Addr. Assistant (address assistent)
- LOS (list of offline-slaves)
- Factory Reset

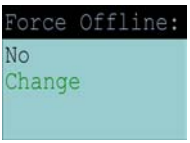
6.5.3 AS-i Slave Adr (Set/Change Slave Address)



With this function the address of a slave can be changed.

To change the address select the menu entry "OLD ADDRESS" and afterwards select the address of the slave which address schould be changed. The new address of the slave has to be set in the menu entry "NEW ADDRESS". The addressing is carried out by pressing the OK button.

6.5.4 Force Offline



This function shows the current state of the AS-i Master:

Yes: AS-i Master is offline.
No: AS-i Master is online.

With "Change", this state can be modified.

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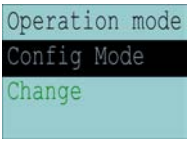
Switching the AS-i master offline puts the AS-i circuit into the safe state. The AS-i master has to be offline if an AS-i slave should be addressed via the IR-interface.

6.5.5 Operation Mode



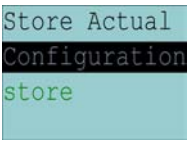
This function shows the current operation mode of the AS-i master:

Protected Mode: Protected mode
Config Mode: Configuration mode

With "Change" you can switch to the other operation mode.

Only in configuration mode parameters and configuration data can be stored.

6.5.6 Store Act Cfg (Store Actual Detected Configuration)



This function can only be executed in configuration mode.

This function enables you to store the configuration of all slaves which are connected and detected on the selected AS-i circuit.

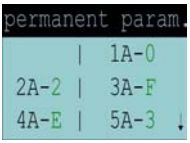
If "Store" was successful, the LED "Config error" is off. The configuration is stored, the configuration error has been eliminated.

If one of the connected slaves has a peripheral fault, the LED "Config error" will flash.

If the AS-i master is in protected mode, the following error message will appear: "Failed No Config Mode"

If an AS-i slave with address zero exists, storing the configuration will be confirmed with "OK". However, the configuration error remains because address zero is not a valid operating address for storing a slave.

6.5.7 Permanent Param (Projected Parameter)



This function allows you to set the permanent parameters. A list of all slaves is displayed from 1A - 31A and from 1B - 31B. The permanent parameters for single slaves are set from address 1A - 31A. The parameter is shown as a hexadecimal value behind the slave address.

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6.5.8 Permanent Config (Projected Configuration Data)

With this function the projected configuration data can be projected. The values for the configuration data are displayed behind the slave address in the following order:

IO (I/O-configuration) ID (ID-configuration) xID1 (extended ID1)
xID2 (extended ID2).

6.5.9 AS-i Address Assistant

The AS-i address assistant helps you to set up the AS-i circuit quickly. Once you have stored the AS-i configuration, the AS-i address assistant addresses a new AS-i slave with address zero to the desired address.

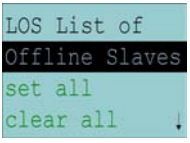
Selecting "Assistant on" or "Assistant off" switches the AS-i address assistant on or off. The current state of the AS-i address assistant is displayed:

Assistant on: AS-i address assistant is switched on.
Assistant off: AS-i address assistant is switched off.

Procedure:

1. Store AS-i Configuration to the master. This can be done very comfortably with the Windows software AS-i Control Tools (Master | Write configuration to the AS-i Master ...), or directly with the fullgraphic display (see chapter 6.5.8).
2. All AS-i slaves have to be addressed to 0 or to the desired address. The slaves must be disconnected from the AS-i circuit.
3. Start the AS-i address assistant.
4. Now connect the AS-i slaves one after the other. The last line of the display of the AS-i address assistant shows which AS-i slave has to be connected next.

6.5.10 LOS (List of Offline Slaves)



See also "Advanced Diagnostics for AS-i Masters", chapter 7.

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With "Clear all" and "Set all" you can delete or set a single bit for each AS-i slave address. Underneath there is a list of all slaves, by which the LOS bit can be set or deleted by individualy selecting of the LOS bit.

Empty field: LOS bit deleted
X: LOS bit set

6.5.11 Auto Adr Enable (Enable Automatic Address Programming)

With this function the automatic address programming can be released or locked.

Meaning of the displayed mode:

Enable: Automatic address programming is released.
Disable: Automatic address programming is locked.

With "CHANGE" you can switch to the other mode.

6.5.12 Factory Reset

With this function the master can be reseted to the factory setting. The reset can be chosen by selecting the menu entry "DO RESET".

This function schould be chosen only in case of emergency, because all stored settings are reset to factory setting and therfore a perfect communication and working of the master is not guarnateed any more.
The master and the AS-i circuit have to be recommissioned and reprojected again after a successful "Reset".
By double masters the reset have an effect on both AS-i masters!

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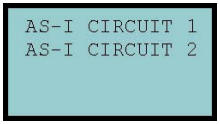
6.6 IO + Param. Test (Testing AS-i In- and Outputs as well as reading and writing AS-i Parameters)

6.6.1 AS-i Circuit



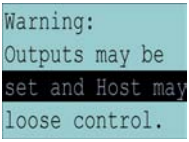
To reach this setup menu you have to change the desired AS-i circuit by using the arrow and the OK buttons.

The function is only implemented in the double master.

It makes possible to change the AS-i circuit that is currently active for being operated.

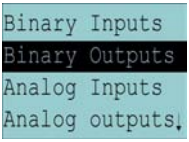
The active circuit is marked by the cursor.

6.6.2 IO + Param. Test (Testing AS-i In- and Outputs as well as reading and writing AS-i Parameters)



Before changing to the menu the following warning message will displayed:

"Warning: Outputs may be set and Host may lose control."



The menu "IO + Param.Test" enables you to choose one of the following submenues:

- Binary Inputs
- Binary Outputs
- Analog Inputs
- Analog Outputs
- Parameter

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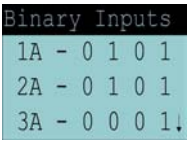
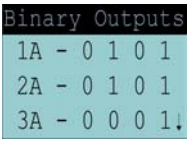
6.6.3 Binary Input



This list shows the state of the binary inputs for all AS-i slaves.

0: Input deleted
1: Input set

6.6.4 Binary Outputs

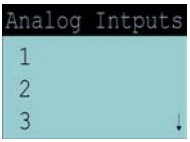


This function shows the state of the binary outputs for all AS-i slaves.

0: Output deleted
1: Output set

The binary outputs can be changed after selecting the desired AS-i slave.

6.6.5 Analog Inputs

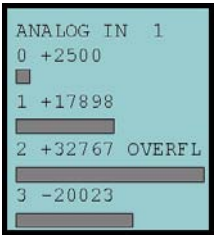


This function shows the state of the analog inputs for all AS-i slaves.

The display is as follows:

AS-i slave address, hexadecimal 16 bit value, bar display indicating the input or output value

An eventual value overflow is displayed by "Overfl" additionally.



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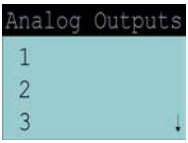
6.6.6 Analog Outputs

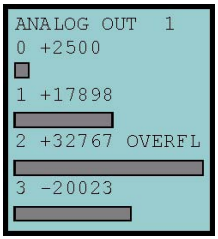


This function shows the state of the analog outputs for all AS-i slaves.

The display is as follows:

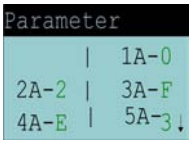
AS-i slave address, hexadecimal 16 bit value, bar display

An possible value overflow is displayed by "Overfl" additionally.



The analog outputs can be changed after selecting the desired AS-i slave.

6.6.7 Parameter



This function shows the hexadecimal value of the current AS-i parameters for all AS-i slaves.

The actual AS-i parameters can be changed after selecting the desired slave address.

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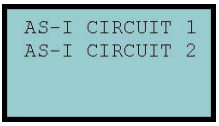
6.7 Diagnosis (Normal AS-i Diagnosis)

6.7.1 AS-i Circuit



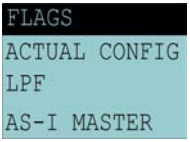
To reach this setup menu you have to change the desired AS-i circuit by using the arrow and the OK buttons.

The function is only implemented in the double master.

It makes possible to change the AS-i circuit that is currently active for being operated.

The active circuit is marked by the cursor.

6.7.2 Diagnosis (Normal AS-i Diagnosis)



The menu "Diagnosis" enables you to choose one of the following submenues:

- Flags (EC-Flags: Execution control flags)
- Actual Config (actual configuration)
- LPF (list of periphery faults)
- AS-i Master (Info)

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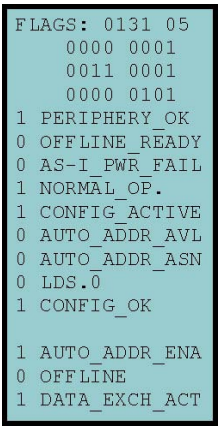
6.7.3 Flags



This function shows the EC-flags hexadecimaly, binary and as single bits beginning with the lowest-order bit.

Arrangement of the bits within the byte:

Byte								
Bit value:	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Bit.	7	6	5	4	3	2	1	0

Byte 1:

Bit 0: Periphery_OK
This flag is set, if no AS-i slave signs a periphery fault.

Byte 2:

Bit 0: Config_OK
The flag is set, if the projected configuration corresponds with the actual configuration.

Bit 1: LDS.0
The flag is set, if an AS-i slave with address 0 has been detected.

Bit 2: Auto_Addr_Asn
The flag is set, if the automatic addressing is possible (AUTO_ADDR_ENABLE = 1; no "incorrect" AS-i slave is conntected to AS-i).

Bit 3: Auto_Addr_Avl
The flag is set, if the automatic addressing is possible. This means that exactly one slave is failed.

Bit 4: Config_Active
The flag is set in the configuration mode and is reset in the protected mode.

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Bit 5: Normal_Op.
The flag is set, if the AS-i master is in normal operation.

Bit 6: AS-i Pwr Fail
The flag is set, if the AS-i circuit is not sufficiently powered.

Bit 7: Offline_Ready
The flag is set, if the AS-i master is in the offline phase.

Byte 3:

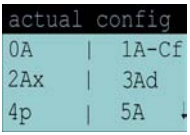
Bit 0: Data_Exch_Act
If the flag "Data Exchange Active" is set, the data exchange is released with the AS-i slaves in the data exchange phase. If the bit is not set, the data exchange with AS-i slaves will be locked. Instead of data telegramms READ_ID telegramms will be sent.
The bit is set by the AS-i master by change over in the offline phase.

Bit 1: Offline
This bit is set if the operating mode offline is to be or already taken.

Bit 2: Auto_Addr_Ena
This flag indicates if the automatic addressing is locked (bit = 0) or released (bit = 1) by the user.

(See also „Get Flags (GET_FLAGS)“, page 71)

6.7.4 Actual Config (Actual Configuration)



This function shows the state of the actual configuration of the individual AS-i slaves.

At the end of the list there is a help text describing the abbreviations:

X (O.K.): The configuration data of the detected AS-i slave matches the projected configuration data.

D (Detected Only): An AS-i slave is detected at this address, but not projected.

P (Projected Only): An AS-i slave is projected at this address, but not detected.

C (Type Conflict): The configuration data of the detected AS-i slave does not match the projected configuration data. The actual detected configuration of the connected AS-i slave is displayed.

F (Periph. Fault): The AS-i slave has a peripheral fault.

After selecting the desired AS-i slave address the values for the actual configuration data are displayed behind the respective address in the following order:

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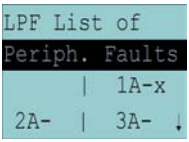
IO (I/O-configuration) ID (ID-configuration) xID1 (extended ID1)
xID2 (extended ID2)

Furthermore the state of the configuration is displayed in plain text.

If no AS-i slave is detected and no AS-i slave is projected at a certain address, four dots instead of the configuration data are displayed.

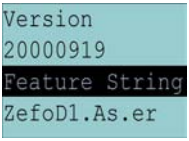
6.7.5 LPF (List of Periphery Faults)



The list shows AS-i slaves, which have released a peripheral fault.

Empty field: Periphery O.K.
X: Peripheral fault

6.7.6 AS-i Master (Info)

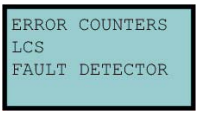


This function shows information about the version and the features of the AS-i master.

Version xxxxxxxx (date of the firmware)

Feature String xxxxxxxxxxxxxxxx

6.8 Adv. Diagnosis (Advanced AS-i Diagnosis)



See also "Advanced Diagnostics for AS-i Masters", chapter 7.

In the menu "Adv. Diagnosis", the following submenues can be found:

- Error Counters
- LCS (list of slaves, that produced a configuration error)
- Fault Detector

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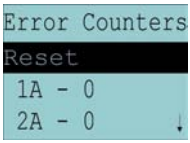
6.8.1 Error Counters

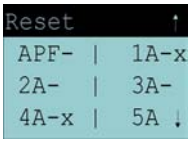


This list shows the error counter for each single AS-i slave.

Furthermore the number of power failures on AS-i (APF) is displayed.

By selecting "Reset", the error counters are reset to 0.

6.8.2 LCS (List of Slaves having caused a Configuration Error)

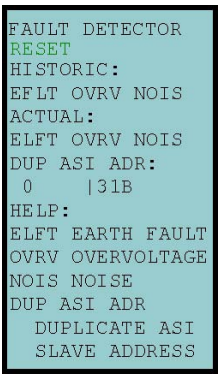


This list shows for each single AS-i slave whether at least one configuration error was caused by an enormous telegram transmission. This function is especially important if the configuration error only occurs short-time.

Empty field: No error

X: AS-i slave caused a configuration error.

6.8.3 Fault Detector



The menu "Fault Detector" shows information about the AS-i detector and allows deleting of the AS-i detector´s history. Furthermore a list of abbreviations in plain language can be found is in the section "Help".

By selecting "Reset" the history of the AS-i detector can be deleted.

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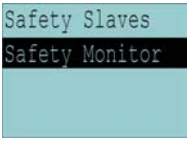
In the section "Historic" the appeared error messages of the AS-i detector are listed since the last "Reset".

In the section "Actual." the actual appeared error messages of the AS-i detector are listed.

Following error messages are possible:

- Duplicate address (the 2 lowest slave addresses are displayed, at which a duplicate address exist).
- Earth faults
- Noise
- Overvoltage

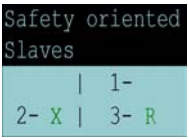
6.9 AS-i Safety



This function shows information about the safety slaves and the safety monitor:

- Safety Slaves
- Safety Monitor

6.9.1 Safety Slaves



This list shows the "safety-directed input slaves" ("AS-i Safety at Work"), by which the safety function is released.

Empty field	
X:	o.k.
R:	released

The slaves according to profile S-7.B or S-0.B are listed here, by which all 4 bits in the IDI are deleted. Therefore slaves with 2 contacts are entered only if both contacts are released.

Since the safety function of a safety-directed input slave can be released even if the slave does not exchange data with the AS-i master, the list may be used only in combination with the ec-flags.

Only CDI and IDI are used for creating this list. Safety slaves which are projected but not existing, and existing slaves sending a wrong code are not listed here.

This list is not constantly updated; it is created from the image of the digital inputs IDI, if required.

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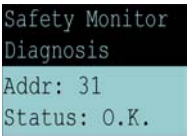
6.9.2 Safety Monitor



The AS-i safety monitor reads the diagnosis data out of the AS-i safety monitor and shows this data in the display. The meaning of the shown diagnosis can be seen in the description of the safety monitor.

6.10 Language

With this function the language of the user interface can be changed by using the arrow and OK buttons.

Following languages are available:

- German
- Englisch
- French
- Italian

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7 Advanced Diagnostics for AS-i Masters

The advanced AS-i diagnostics serve to locate occasionally occurring errors and to judge the quality of data transmission on AS-i without additional diagnostics tools.

"AS-i Control Tools" (software for comfortable commissioning of AS-Interface and programming of AS-i Control) supports the operation of the advanced diagnostics (LCS, error counters and LOS).

7.1 List of Corrupted AS-i Slaves (*LCS*)

The *LCS* contains the history of the delta list. Besides the list of projected slaves (*LPS*), the list of detected slaves (*LDS*) and the list of activated slaves (*LAS*), a fourth list, the **list of corrupted slaves (*LCS*)**, is created by AS-i masters with advanced diagnostics in order to locate occasionally occurring short-time configuration errors. This list contains entries of all AS-i slaves which were responsible for at least one configuration error since powering up the AS-i master or reading the list. Short-time AS-i power failures are listed in the *LCS* at the position of AS-i slave with address 0.

Note

With every read access the LCS will be deleted.

Note

The last short-time configuration error can also be displayed on the AS-i master:
Pressing the "Set" button of the AS-i master shows the AS-i slave which was responsible for the last short-time configuration error. If there was a short-time AS-i power failure the display shows "39" after pressing the "Set" button.
This function is only available if the device is in the normal operation mode of the protected mode (display empty) or in the off-line-phase.

7.2 Protocol Analysis: Counters of Corrupted Data Telegrams

The AS-i master with advanced diagnostics has a counter of telegram repetitions for each AS-i slave, which count up every time a currupted data telegram has been found. This makes possible to judge the quality of the AS-i network, even if only a few corrupted telegrams occured and the AS-i slave did not cause any configuration errors.

Note

The counter values can be read via the host interface and will be deleted with every read access. The counter value is limited to 254. 255 will cause a counter overflow.

The protocol analysis is included in the sofware "AS-i Control Tools" by using the command master | AS-i Diagnostics.

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7.3 Offline Phase on Configuration Errors (*LOS*)

The AS-i masters with advanced diagnostics offer the possibility to put themselves into the offline phase when a configuration error on the AS-Interface occurs. This way the security of the application can be ensured. The reaction to a configuration error is very fast and the host can be relieved from this task. If there are any problems on the AS-i network, the AS-interface can be switched to a secure state.

There are two different ways to parameterize the AS-i master for this feature:

- Every configuration error during normal operation in protected mode releases the off-line phase.
- For each slave address, it can be chosen whether a configuration error on this address will cause the offline phase or not. This information is stored in the list of offline slaves (*LOS*).
  The user himself can decide how the system reacts to a configuration error on the AS-Interface. The AS-i master can release the off-line phase in critical situations, i. e. only with certain slave addresses, whereas in less critical situations (if one of the other AS-i slaves has a configuration error) only the error message is sent to the host, but AS-i is still running.

The parameterization "off-line phase on configuration error" is also supported by the "AS-i Control Tools" (command Master | Identity | Offline on configuration error).

Two ways to reset the error message "OFFLINE BY LOS" are possible:

1. Deleting of the complete list LOS of the affected AS-i circuit ("CLEAR ALL").
2. Voltage reset at the affected AS-i circuit.

By voltage reset at the As-i circuit 1 the complete double gateway will be shut down.

7.4 Functions of the AS-i Fault Detector

7.4.1 Recognition of Duplicate Addresses

If two slaves have the same address in an AS-i circuit, a duplicate address exists. Because of this error the master can not send a request to each slave seperately. At that time both repsonses overlap themselves on the line, it is impossible for the master to recognize the slave response safely. It exists an unstable network behaviour.

The function "recognition of duplicate addresses" allows to recognize a duplicate address and to indicate this both via PROFIBUS and in the AS-i Control Tools.

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A duplicate address causes a configuration error und will be shown in the diplay of the master.

Note

Duplicate addresses can be recognized only in the AS-i segment directly at the master. If both slaves participate in a duplicate address located behind a repeater, the recognition of duplicate addresses is impossible.

7.4.2 Earth Fault Detector

If one of the both AS-i lines is connected conductivly with the plant earth, it exists an earth fault. This error limits the fail-safe characteristic of the AS-i transmission substantially.

Earth faults are indicated in the master´s display as well as via PROFIBUS and the AS-i Control Tools.

Note

For recognition of earth faults the master must be grounded with the function earth.

7.4.3 Noise Detector

The noise detector detects alternating voltages on AS-i, which are not produced by AS-i master or AS-i slaves. These interference voltages can cause telegram disturbances.

A frequent cause are insufficiently shielded frequency inverters or awkwardly shifted cables.

Noises are indicated in the master´s display as well as via PROFIBUS and the AS-i Control Tools.

7.4.4 Overvoltage Detector

Overvoltages are present, if the AS-i line, whose veins lie normally electrically symmetrically to the plant earth, are strongly electrically raised. A cause can be e.g. power-on procedures of large consumers. However sometimes overvoltages don´t generally disturb AS-i communication, but can release incorrect signals of sensors.

Overvoltages are indicated in the master´s display as well as via PROFIBUS and the AS-i Control Tools.

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8 PROFIBUS DP

This chapter contains all necessary information to operate the AS-i/PROFIBUS gateways in a PROFIBUS DP network.

8.1 DP Telegrams

8.1.1 Diagnosis

DP Diagnosis - Single Master					
PDU byte	user byte		DP	DP V1	user
1	–	station_status 1	✔		
2	–	station_status 2	✔		
3	–	station_status 3	✔		
4	–	master address	✔		
5	–	ident high	✔		
6	–	ident low	✔		
7	1	header	✔	✔	
8	2	type		✔	
9	3	slot		✔	
10	4	spec		✔	
11	5	ec-flags (high)			✔
12	6	ec-flags (low)			✔
13	7	delta (0…7)			✔
14	8	delta (8…15)			✔
…	…	…			…
20	14	delta (56…63)			✔
21	15	LPF (0…7)			✔
…	…	…			…
28	22	LPF (56 … 63)			✔

ec-flags (high):

Bit 0: periphery fault
Bit 1 … Bit 3 reserved
Bit 4: earth fault
Bit 5: over voltage
Bit 6: noise
Bit 7: duplicate address

ec-flags (low):

Bit 0: configuration error
Bit 1: slave with address0 detected
Bit 2: Auto_address_assignment not possible
Bit 3: Auto_address_assingment available
Bit 4: configuration mode actice
Bit 5: not in normal operation

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Bit 6: AS-i power fail
Bit 7: AS-i master is offline

Delta List: List of AS-i slaves with configuration error.
1: ConfigError
0: no ConfigError

LPF: List of AS-i slaves with periphery fault.
1: periphery fault
0: no periphery fault

Each element of the user diagnosis (ec-flags and slave lists) can be switched off by setting the appropriate bit in the parameter telegram.

Each element which is not used will be filled up with zeroes. This way the data elements in the diagnosis telegram will keep its designated position (and clear text diagnosis still fits to the data).

Only if an element at the end of the user diagnosis is not used, the length of the diagnosis will be shortened.

ExtDiag will be set if at least one of the following conditions is fulfilled:

- ConfigError ≡ 1
- APF ≡ 1
- PeripheryFault ≡ 1

The conditions when to set the ExtDiag bit can be chosen using the user parameters or the commands of the command interface.

The GSD file includes the following presettings:

- The diagnosis transmitts ec-flags, delta list and LPF.
- ExtDiag will be set if ConfigError = 1 and APF = 1. ExtDiag will not be set if there is a periphery fault.

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If a double master is being used, the User-Diagnosis-Bytes 5 to 30 represent AS-i network 1 and the User-diagnosis bytes 31 to 56 represent AS-i network 2.

DP Diagnosis - Double Master					
PDU byte	user byte		DP	DP V1	user
1	–	station_status 1	✔		
2	–	station_status 2	✔		
3	–	station_status 3	✔		
4	–	master address	✔		
5	–	ident high	✔		
6	–	ident low	✔		
7	1	header	✔	✔	
8	2	type		✔	
9	3	slot		✔	
10	4	spec		✔	
11	5	ec-flags (high), circuit 1			✔
12	6	ec-flags (low), circuit 1			✔
13	7	delta (0…7), circuit 1			✔
14	8	delta (8…15), circuit 1			✔
…	…	…			…
20	14	delta (56…63), circuit 1			✔
21	15	LPF (0…7), circuit 1			✔
…	…	…			…
28	22	LPF (56 … 63), circuit 1			✔
29	23	reserved			✔
…	…	…			…
36	30	reserved			✔
37	31	ec-flags (high), circuit 2			✔
38	32	ec-flags (low), circuit 2			✔
39	33	delta (0…7), circuit 2			✔
40	34	delta (8…15), circuit 2			✔
…	…	…			…
46	40	delta (56…63), circuit 2			✔
47	41	LPF (0…7), circuit 2			✔
	…	…			…
54	48	LPF (56 … 63), circuit 2			✔

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8.1.1.1 Parameters

With the user parameters you can choose if and which slave list will be displayed in the diagnosis. Furthermore you can select which conditions have to be fulfilled to set the ExtDiag bit within the diagnosis telegram.

DP Parameters - Single Master						
PDU byte	user byte		DP	DP V1	user	default
1	–	Station_Status	✔			
2	–	WD_Fact_1	✔			
3	–	WD_Fact_2	✔			
4	–	min T_{sdr}	✔			
5	–	Ident High	✔			
6	–	Ident Low	✔			
7	–	Group_Ident	✔			
8	1	DPV Status 1		✔		80_{16}
9	2	DPV Status 2		✔		00_{16}
10	3	DPV Status 3		✔		00_{16}
11	4	User Byte 1			✔	$0B_{16}$
12	5	User Byte 2			✔	06_{16}
13	6	User Byte 3			✔	00_{16}

The bits in "User Byte 1" and "User Byte 3" have the following meanings:

User Byte 1								
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	-	-			LPF	–	D	F
default	0	0		0	1	0	1	1

User Byte 2								
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	FD	0		CS	PF	APF	CF	–
default	0	0		0	0	1	1	0

User Byte 3								
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	–				0			
default	0				0			

LPF: 1: LPF will be transmitted in the diagnosis
0: LPF will not be transmitted

D: 1: Delta list will be transmitted in the diagnosis
0: Delta list will not be transmitted

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F: 1: EC-flags will be transmitted in the diagnosis
0: EC-flags will not be transmitted

FD: If this bit is set, the PROFIBUS diagnosis is refreshed only if the PROFIBUS norm dictates this ("freeze diagnosis"). In doubt the data of the PROFIBUS masters diagnosis are not up to date.

CS: 1: ExtDiag will be set if the LCS is not empty
0: ExtDiag will not be set if the LCS is not empty

PF: 1: ExtDiag will be set if there is a periphery fault at the AS-i line
0: ExtDiag will not be set.

APF: 1: ExtDiag will be set if there is an AS-i Power Fail
0: ExtDiag will not be set.

CF: 1: ExtDiag will be set if there is a configuration error
0: ExtDiag will not be set.

The GSD's default user parameter telegram is:

80_{16}	00_{16}	00_{16}	$0B_{16}$	06_{16}	00_{16}

(DPV1 enabled, diagnosis settings according to chapter 8.1.1)

If a double master is being used, the data for AS-i circuit are transmitted in the user parameter bytes 4 to 6. For circuit 2 3 additional bytes are added.

DP Parameters - Double Master						
PDU byte	user byte		DP	DP V1	user	default
1	–	Station_Status	✔			
2	–	WD_Fact_1	✔			
3	–	WD_Fact_2	✔			
4	–	min T_{sdr}	✔			
5	–	Ident High	✔			
6	–	Ident Low	✔			
7	–	Group_Ident	✔			
8	1	DPV Status 1		✔		80_{16}
9	2	DPV Status 2		✔		00_{16}
10	3	DPV Status 3		✔		00_{16}
11	4	User Byte 1, circuit 1			✔	$0B_{16}$
12	5	User Byte 2, circuit 1			✔	06_{16}
13	6	User Byte 3, circuit 1			✔	00_{16}
14	7	User Byte 1, circuit 2			✔	$0B_{16}$
15	8	User Byte 2, circuit 2			✔	06_{16}
16	9	User Byte 3, circuit 2			✔	00_{16}

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8.1.2 Configuration DP V0 (cyclic data)

The configuration of the AS-i/PROFIBUS gateways is made with the GSD file. Therefore the provided GSD file has to be imported into your PROFIBUS configuration tool.

8.1.2.1 AS-i-V2.1 Mode

In AS-i V2.1 mode the input and output data field can be used with various "special IDs".

The advantages of special input and output IDs are, that they can include up to 64 elements (bytes or words), and that the length of input and output data can be different. Additionally, "manufacturer specific" data bytes describing the ID type are possible. These "manuafaturer specific" data bytes describe the which type ID is.

The GSD file offers here several combinations (several lengths) for transmitting I/O date, command interface (management) and analog data.

Therefore the analog data can be transmitted directly in the process data channel and do not have to be requested by the slower DP V1 commands.

The detailed possibilities:

Length	Description
4 bytes	digital input (slaves 0 - 7)
8 bytes	digital input (slaves 0 - 15)
12 bytes	digital input (slaves 0 - 23)
16 bytes	digital input (slaves 0 - 31)
20 bytes	digital input (slaves 0 - 7B)
24 bytes	digital input (slaves 0 - 15B)
28 bytes	digital input (slaves 0 - 23B)
32 bytes	digital input (slaves 0 - 31B)

Length	Description
4 bytes	digital output (slaves 0 - 7)
8 bytes	digital output (slaves 0 - 15)
12 bytes	digital output (slaves 0 - 23)
16 bytes	digital output (slaves 0 - 31)
20 bytes	digital output (slaves 0 - 7B)
24 bytes	digital output (slaves 0 - 15B)
28 bytes	digital output (slaves 0 - 23B)
32 bytes	digital output (slaves 0 - 31B)

Length	Description
16 bytes	digital in/out (slaves 0 - 31)
16 Bytes	digital in/out (slaves 0B - 31B)
32 bytes	digital in/out (slaves 0 - 31B)

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Length	Description
2 bytes	management (command interface)
4 bytes	management (command interface)
8 bytes	management (command interface)
11 bytes	management (command interface)
12 bytes	management (command interface)
34 bytes	management (command interface)
36 bytes	management (command interface)

Length	Description
24 bytes	analog input (slaves 29 - 31)
56 bytes	analog input (slaves 25 - 31)
88 bytes	analog input (slaves 21 - 31)
120 bytes	analog input (slaves 17 - 31)
128 bytes	analog input (slaves 16 - 31)
16 bytes	analog input (slaves 14 - 15)

Length	Description
24 bytes	analog output (slaves 29 - 31)
56 bytes	analog output (slaves 25 - 31)
88 bytes	analog output (slaves 21 - 31)
120 bytes	analog output (slaves 17 - 31)
128 bytes	analog output (slaves 16 - 31)
16 bytes	analog output (slaves 14 - 15)

Length	Description
2 bytes … 128 bytes	analog input data circuit 1, dynamic[1]
2 bytes … 128 bytes	analog output data circuit 1, dynamich[1]
2 bytes … 128 bytes	analog input data circuit 2, dynamic[1]
2 bytes … 128 bytes	analog output data circuit 2, dynamic[1]
2 bytes	flags and AS-i detector circuit 1
2 bytes	flags and AS-i detector circuit 2

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8.1.3 I/O Data

8.1.3.1 Process data

In V2.1 mode the AS-i I/O data are mapped in the process data as known from the Siemens and AS-i/InterBus masters. This means that the lower nibble describes the data of the AS-i slave with the higher slave address. The ec-flags or hi-flags are additionaly mapped at the nibble of AS-i slave 0.

byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	flags				slave 1/1A			
	F3	F2	F1	F0	D3	D2	D1	D0
1	slave 2/2A				slave 3/3A			
2	slave 4/4A				slave 5/5A			
3	slave 6/6A				slave 7/7A			
4	slave 8/8A				slave 9/9A			
5	slave 10/10A				slave 11/11A			
6	slave 12/12A				slave 13/13A			
7	slave 14/14A				slave 15/15A			
8	slave 16/16A				slave 17/17A			
9	slave 18/18A				slave 19/19A			
10	slave 20/20A				slave 21/21A			
11	slave 22/22A				slave 23/23A			
12	slave 24/24A				slave 25/25A			
13	slave 26/26A				slave 27/27A			
14	slave 28/28A				slave 29/29A			
15	slave 30/30A				slave 31/31A			
16	reserved				slave 1B			
17	slave 2B				slave 3B			
18	slave 4B				slave 5B			
19	slave 6B				slave 7B			
20	slave 8B				slave 9B			
21	slave 10B				slave 11B			
22	slave 12B				slave 13B			
23	slave 14B				slave 15B			
24	slave 16B				slave 17B			
25	slave 18B				slave 19B			
26	slave 20B				slave 21B			
27	slave 22B				slave 23B			
28	slave 24B				slave 25B			
29	slave 26B				slave 27B			
30	slave 28B				slave 29B			
31	slave 30B				slave 31B			

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Flags		
	input data	output data
F0	ConfigError	Offline
F1	APF	LOS master bit
F2	PeripheryFault	→ ConfigurationMode
F3	ConfigurationActive	→ ProtectedMode

ConfigError: 0 = ConfigOK, 1 = ConfigError
APF: 0 = AS-i Power OK, 1 = AS-i Power Fail
PeripheryFault: 0 = PeripheryOK, 1 = PeripheryFault
ConfigurationActive: 0 = ConfigurationActive, 1 = ConfigurationInactive
Offline: 0 = Online, 1 = Offline
LOS-Master-Bit 0 = Offline by ConfigError deactivated
1 = Offline by ConfigError activated

A rising edge of F2 and F3 switch the master to the desired mode.

A rising edge of the "LOS master bit" effects that all bits in the *LOS* are set. A falling edge effects that all bits are deleted.

8.1.3.2 Analog data

In addition to the access via the command interfaces, the analog data for or by the slaves can by exchanged cyclically according to profile 7.3. Competing writing access attemps on analog output data will not be blocked by each other. If analog output data for a particular slave are being transmitted both cyclically and acyclically with the command interface or via DP V1 connections, the acyclically transmitted values will be overwritten by the cyclically transmitted values.

Analog AS-i data according to profile 7.3 can be transmitted in a reserved data area. Therefore accessing analog data is as easy as accessing digital data.

Analog data								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	slave 31-n/8, channel 1, high byte							
2	slave 31-n/8, channel 1, low byte							
3	slave 31-n/8, channel 2, high byte							
4	slave 31-n/8, channel 2, low byte							
…	…							
n-1	slave 31, channel 4, high byte							
n	slave 31, channel 4, low byte							

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8.1.3.3 Command Interface

Only using the IDs of the process data field the AS-i/PROFIBUS gateway can be used as M0 AS-i master. By using the command interface (see chapter 8.1.3) the functions of a M3 master become available.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command							
2	T	circuit						
3	request parameter byte 1							
…	…							
36	request parameter byte 34							

Answer								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command (mirrored)							
2	T	result						
3	response parameter byte 1							
…	…							
34	response parameter byte 32							

A command of the command interface will be edited if the toggle bit T has changed. This way the same command can be used repeatedly.

The commands of the command interface can also be activated with PROFIBUS DP V1. Even the process data exchange is possible via the command interface. This way the Windows configuration software "AS-i Control Tools" can run the whole communication via DP V1.

8.2 DP V1

To exchange data between the PROFIBUS master and the AS-i/PROFIBUS gateway via PROFIBUS DP V1 only one data block is used - slot 1, index 16. Within this data block a command interface is installed like the one used in the DP telegram.

The DP V1-command interfaces are edited every time they are sent. Therefore it is possible to execute the same command several times without changing "command" or "circuit"and setting a toggle bit.

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8.3 Restrictions

The SPC3 has only 1,5 KByte DP-RAM available. Therefore the lengths of telegrams and the numbers of DP V1-connections to class 2 masters have to be restricted.

Restrictions due to the SPC3			
MSC1	input data output data diagnosis parameters configuration SetSlaveAddress	144 bytes 144 bytes 36 bytes 12 bytes 32 bytes 4 bytes	(8 advanced identities)
MSAC1	SAPs PDU	1 42 bytes	
MSAC2	SAPs PDU	3 42 bytes	

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9 Command Interface

9.1 Construction

If an AS-i slave is addressed in a command or in a response, the address is structured as shown below

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command							
2	T	–	circuit					
3	request parameter byte 1							
…	…							
36	request parameter byte 34							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command							
2	T	result						
3	response parameter byte 1							
…	…							
36	response parameter byte 34							

Command byte and T-bit are always part of the response. The T-bit is necessary to operate the command interface via a MSC1 connection (PROFIBUS DP V0). This way the same command of the command interface can be used two twice repeatedly, possibly with different parameters.

The execution of a command of the command interface is declined, if the number of the transferred parameters is too small which means that the command interface in the cyclic channel is too small or the DP V1-telegram is too short.

The commandsof the command interface are valid as well for PROFIBUS DP V0 as for PROFIBUS DP V1.

Circuit = 0 If an AS-i gateway with one AS-i master or the master 1 of an AS-i gateway with 2 masters should be choosen.

Circuit = 1 If master 2 of a double master should be chosen.

The commands for reading and writinig exist in two variations. At the first variation the bits in the slave lists are arranged as usually with Murrelektronik products: Data for slave with lower address appear in the lower bits. The second variation is compatible to Siemens masters: The sequence of the bits in the slave lists bytes are inverse.

Switching between the two variations can be done with bit 2^6 in byte 2 of the request. If it is deleted, the Murrelektronik arrangement is selected, otherwise the Siemens compatible arrangement is selected.

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The coding of requests for commands to reading and writing is following therefore:

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command							
2	T	0	circuit					
3	Request parameter byte 1							
…	…							

9.1.1 List of all Commands

Values for command				
command	**value**	**meaning**	**Req Len**	**Res Len**
RD_7X_IN	50_{16}	Read 1 7.3-slave in.data	3	10
WR_7X_OUT	51_{16}	Write 1 7.3-slave out.data	11	2
RD_7X_OUT	52_{16}	Read 1 7.3-slave out.data	3	10
RD_7X_IN_X	53_{16}	Read 4 7.3-slaves in.data	3	34
WR_7X_OUT_X	54_{16}	Write 4 7.3-slaves out.data	35	2
RD_7X_OUT_X	55_{16}	Read 4 7.3-slaves out.data	3	34
WR_74_PARAM	$5A_{16}$	Write S-7.4-slave parameter	≥6	2
RD_74_PARAM	$5B_{16}$	Read S-7.4-slave parameter	4	≥3
RD_74_ID	$5C_{16}$	Read S-7.4-slave ID string	4	≥3
RD_74_DIAG	$5D_{16}$	Read S-7.4-slave diagnosis string	4	≥3
GET_LISTS	30_{16}	Get LDS, LAS, LPS, Flags	2	29
GET_FLAGS	47_{16}	Get_Flags	2	5
GET_DELTA	57_{16}	Get list of config. diff.	2	10
GET_LCS	60_{16}	Get LCS	2	10
GET_LAS	45_{16}	Get_LAS	2	10
GET_LDS	46_{16}	Get_LDS	2	10
GET_LPF	$3E_{16}$	Get_LPF	2	10
GET_LOS	61_{16}	GET_LOS	2	10
SET_LOS	62_{16}	SET_LOS	10	2
GET_TECA	63_{16}	Get transm.err.counters	2	34
GET_TECB	64_{16}	Get transm.err.counters	2	34
GET_TEC_X	66_{16}	Get transm.err.counters	4	≥3
READ_FAULT_DETECTOR	10_{16}	Read Fault Detector	2	4
READ_DUPLICATE_ADDR	11_{16}	Read List of Duplicate Addresses	2	10
SET_OP_MODE	$0C_{16}$	Set_Operation_Mode	3	2
STORE_CDI	07_{16}	Store_Actual_Configuration	2	2
READ_CDI	28_{16}	Read_Actual_Configuration	3	4
SET_PCD	25_{16}	Set_Permanent_Config	5	2

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Values for command				
command	**value**	**meaning**	**Req Len**	**Res Len**
GET_PCD	26_{16}	Get_Permanent_Config	3	4
SET_LPS	29_{16}	SET_LPS	11	2
GET_LPS	44_{16}	Get_LPS	2	10
STORE_PI	04_{16}	Store_Actual_Parameter	2	2
WRITE_P	02_{16}	Write_Parameter	4	3
READ_PI	03_{16}	Read_Parameter	3	3
SET_PP	43_{16}	Set_Permanent_Parameter	4	2
GET_PP	01_{16}	Get_Permanent_Parameter	3	3
SET_AAE	$0B_{16}$	Set_Auto_Address_Enable	3	2
IDLE	00_{16}	No order	2	2
READ_IDI	41_{16}	Read IDI	2	36
WRITE_ODI	42_{16}	Write_ODI	34	2
READ_ODI	56_{16}	Read ODI	2	34
SLAVE_ADDR	$0D_{16}$	Change_Slave_Address	4	2
WRITE_XID1	$3F_{16}$	Write_Extended_ID-Code_1	3	2
SET_OFFLINE	$0A_{16}$	Set_Offline_Mode	3	2
SET_DATA_EX	48_{16}	Set_Data_Exchange_Active	3	2
BUTTONS	75_{16}	Disable pushbuttons	3	2
FP_PARAM	$7D_{16}$	„Functional Profile“ Param.	≥3	≥2
FP_DATA	$7E_{16}$	„Functional Profile“ Data	≥3	≥2
EXT_DIAG	71_{16}	ExtDiag generation	6	2
RD_EXT_DIAG	$7B_{16}$	Read ExtDiag Settings	2	7
INVERTER	$7C_{16}$	Configure Inverter Slaves	12	4

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9.1.2 Values for Results

Values for result			
	value	place	meaning
OK	00_{16}	–	execution without fault
HI_NG	11_{16}	HI	general fault
HI_OPCODE	12_{16}	HI	illegal value in command
HI_LENGTH	13_{16}	HI	length of the command interface in the I/O-data area respectively the length of the DPV1 requests is too short
HI_ACCESS	14_{16}	HI	no access right
EC_NG	21_{16}	EC	general fault
EC_SND	22_{16}	EC	"slave (source addr) not detected"
EC_SD0	23_{16}	EC	"slave 0 detected"
EC_SD2	24_{16}	EC	"slave (target addr) not decteced"
EC_DE	25_{16}	EC	"delete error"
EC_SE	26_{16}	EC	"set error"
EC_AT	27_{16}	EC	"address temporary"
EC_ET	28_{16}	EC	"extended ID1 temporary"
EC_RE	29_{16}	EC	"read (extended ID1) error"

9.2 Commands of the Command Interface

9.2.1 Analog Data

9.2.1.1 Overview of the Commands

Values for command				
command	value	meaning	Req Len	Res Len
RD_7X_IN	50_{16}	Read 1 7.3-slave in.data	3	10
WR_7X_OUT	51_{16}	Write 1 7.3-slave out.data	11	2
RD_7X_OUT	52_{16}	Read 1 7.3-slave out.data	3	10
RD_7X_IN_X	53_{16}	Read 4 7.3-slaves in.data	3	34
WR_7X_OUT_X	54_{16}	Write 4 7.3-slaves out.data	35	2
RD_7X_OUT_X	55_{16}	Read 4 7.3-slaves out.data	3	34
WR_74_PARAM	$5A_{16}$	Write S-7.4-slave parameter	≥6	2
RD_74_PARAM	$5B_{16}$	Read S-7.4-slave parameter	4	≥3
RD_74_ID	$5C_{16}$	Read S-7.4-slave ID string	4	≥3
RD_74_DIAG	$5D_{16}$	Read S-7.4-slave diagnosis string	4	≥3

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9.2.1.2 Read 1 7.3-Slave in.Data (RD_7X_IN)

With this command, the four 16 bit channels of an AS-i input slave according to the slave profile 7.3 can be read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	50_{16}							
2	T	–	circuit					
3	–		0	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	50_{16}							
2	T	result						
3	channel 1, high byte							
…	…							
10	channel 4, low byte							

9.2.1.3 Write 1 7.3-Slave out.Data (WR_7X_OUT)

With this command, the four 16 bit channels of an AS-i output slave according to the slave profile 7.3 can be written.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	51_{16}							
2	T	–	circuit					
3	–		0	slave address				
4	channel 1, high byte							
…	…							
11	channel 4, low byte							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	51_{16}							
2	T	result						

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9.2.1.4 Read 1 7.3-Slave out.Data (RD_7X_OUT)

With this command, the four 16 bit channels of an AS-i output slave according to the slave profile 7.3 can be read out of the AS-i/PROFIBUS gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	52_{16}							
2	T	–	circuit					
3	–		0	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	52_{16}							
2	T	result						
3	channel 1, high byte							
…	…							
10	channel 4, low byte							

9.2.1.5 Read 4 7.3-Slave in.Data (RD_7X_IN_X)

With this command, the four 16 bit channels of 4 AS-i input slaves with succesive addresses according to slave profile 7.3 can be read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	53_{16}							
2	T	–	circuit					
3	–		0	1st slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	53_{16}							
2	T	result						
3	1st slave, channel 1, high byte							
…	…							
34	4th slave, channel 4, low byte							

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9.2.1.6 Write 4 7.3-Slave out.Data (WR_7X_OUT_X)

With this command the four 16 bit channels of four AS-i output slaves with successive addresses according to slave profile 7.3 can be written.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	54_{16}							
2	T	–	circuit					
3	–		0	1st slave address				
4	1st slave, channel 1, high byte							
…	…							
35	4th slave, channel 4, low byte							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	54_{16}							
2	T	result						

9.2.1.7 Read 4 7.3-Slave out.Data (RD_7X_OUT_X)

With this command, the four 16 bit channels of four AS-i output slaves with successive addresses according to slave profile 7.3 can be read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	55_{16}							
2	T	–	circuit					
3	–		0	1st slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	55_{16}							
2	T	result						
3	1st slave, channel 1, high byte							
…	…							
34	4th slave, channel 4, low byte							

9.2.1.8 WR_74_PARAM

With this function the parameter string of a slave according to profile S-7.4 is written. Since the string can be longer than the command interface, it will partly be written into the buffer and then be transferred to the slave.

n is the length of the part of the string which should be written into the buffer from index i on.

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If i ≡ 0, then the string is being transferred to the slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5A_{16}$							
2	T	–	circuit					
3	slave address							
4	i							
5	n							
6	buffer btye i							
…	…							
n+5	buffer byte i+n-1							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5A_{16}$							
2	T	results						

9.2.1.9 RD_74_PARAM

With this function the parameter string according to profile S-7.4 is being read. Since the string can be longer than the command interface, it is written into the buffer. The content of the buffer can read in parts from index i.

The first byte of the buffer is the length of the read string.

If i ≡ 0, the string is being read from the slave, otherwise the function responses out of the memory; the data can be read consistently.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5B_{16}$							
2	T	–	circuit					
3	slave address							
4	i							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5B_{16}$							
2	T	result						
3	buffer byte i							
…	…							
n+2	buffer byte i+n-1							

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9.2.1.10 RD_74_ID

With this function the ID string of a slave according to profile S-7.4 is is being read. Since the string can be longer than the command interface, it is written into the buffer. The content of the buffer can read in parts from index i.

The first byte of the buffer is the length of the read string.

If i ≡ 0, the string is being read from the slave, otherwise the function responses out of the memory, the data can be read consistently.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5C_{16}$							
2	T	–	circuit					
3	slave address							
4	i							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5C_{16}$							
2	T	result						
3	buffer byte i							
…	…							
n+2	buffer byte i+n-1							

9.2.1.11 RD_74_DIAG

With this function the diagnosis string of a slave according to profile S-7.4 is being read. Since the string can be longer than the command interface, it is written into the buffer. The content of the buffer can be read in parts from index i.

The first byte of the buffer indicates the length of the read string.

If i ≡ 0, the string is being read from the slave, otherwise the function responses out of the memory, the data can be read consistently.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5D_{16}$							
2	T	–	circuit					
3	slave address							
4	i							

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5D_{16}$							
2	T	result						
3	buffer byte i							
…	…							
n+2	buffer byte i+n-1							

9.2.2 Diagnosis Data

9.2.2.1 Overview of the Commands

Values for command				
Command	value	meaning	Req Len	Res Len
GET_LISTS	30_{16}	Get LDS, LAS, LPS, Flags	2	29
GET_FLAGS	47_{16}	Get_Flags	2	5
GET_DELTA	57_{16}	Get list of config. diff.	2	10
GET_LCS	60_{16}	Get LCS	2	10
GET_LAS	45_{16}	Get_LAS	2	10
GET_LDS	46_{16}	Get_LDS	2	10
GET_LPF	$3E_{16}$	Get_LPF	2	10
GET_LOS	61_{16}	GET_LOS	2	10
SET_LOS	62_{16}	SET_LOS	10	2
GET_TECA	63_{16}	Get transm.err.counters	2	34
GET_TECB	64_{16}	Get transm.err.counters	2	34
GET_TEC_X	66_{16}	Get transm.err.counters	4	≥3
READ_FAULT_DETECTOR	10_{16}	Read Fault Detector	2	4
READ_DUPLICATE_ADDR	11_{16}	Read List of Duplicate Addresses	2	10

9.2.2.2 Get Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) (GET_LISTS)

With this call, the following entries are read out of the AS-i/PROFIBUS gateway:

- The list of active AS-i slaves (LAS)
- The list of detected AS-i slaves (LDS)
- The list of projected AS-i slaves (LPS)
- The flags according to the AS-i slave specification

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	30_{16}							
2	T	O	circuit					

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Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	30_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	LAS							
10	31B	30B	29B	28B	27B	26B	25B	24B
11	7A	6A	5A	4A	3A	2A	1A	0A
…	LDS							
18	31B	30B	29B	28B	27B	26B	25B	24B
19	7A	6A	5A	4A	3A	2A	1A	0A
…	LPS							
26	31B	30B	29B	28B	27B	26B	25B	24B
27	–							Pok
28	OR	APF	NA	CA	AAv	AAs	S0	Cok
29	–					AAe	OL	DX

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	30_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	LAS							
10	24B	25B	26B	27B	28B	29B	30B	31B
11	0A	1A	2A	3A	4A	5A	6A	7A
…	LDS							
18	24B	25B	26B	27B	28B	29B	30B	31B
19	0A	1A	2A	3A	4A	5A	6A	7A
…	LPS							
26	24B	25B	26B	27B	28B	29B	30B	31B
27	–							Pok
28	OR	APF	NA	CA	AAv	AAs	S0	Cok
29	–					AAe	OL	DX

Pok Periphery_Ok
S0 LDS.0
AAs Auto_Address_Assign
AAv Auto_Address_Available
CA Configuration_Active
NA Normal_Operation_Active
APF APF
OR Offline_Ready

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Cok Config_Ok
AAe Auto_Address_Enable
OL Offline
DX Data_Exchange_Active

9.2.2.3 Get Flags (GET_FLAGS)

With this call, the following entry is read out of the AS-i/PROFIBUS gateway: The flags according to the AS-i slave specification.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	47_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	47_{16}							
2	T	response						
3	–							Pok
4	OR	APF	NA	CA	AAv	AAs	S0	Cok
5	–					AAe	OL	DX

Pok Periphery_Ok
This flag is set when no AS-i slave is signaling a peripheral fault.

S0 LDS.0
This flag is set when an AS-i slave with address 0 exists.

AAs Auto_Address_Assign
This flag is being set when the automatic address programming is possible (in other words, AUTO_ADDR_ENABLE = 1; no "incorrect" slave connected to the AS-i).

AAv Auto_Address_Available
This flag is set when the automatic address programming can be executed, exactly one AS-i slave is currently out of operation.

CA Configuration_Active
The flag is set in configuration mode and reset in protected mode.

NA Normal_Operation_Active
This flag is set when the AS-i master is in normal operation.

APF AS-i Power Fail
This flag is set when the voltage on the AS-i cable is too low.

OR Offline_Ready
The flag is set when the offline phase is active.

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Cok Config_Ok
This flag is set when the desired (configured) and actual configuration match.

AAe Auto_Address_Enable
This flag indicates whether the automatic address programming is enabled (bit = 1) or disabled (bit = 0) by the user.

OL Offline
This flag is set when the mode should be changed to OFFLINE or when this mode has already been reached.

DX Data_Exchange_Active
If the "Data_Exchange_Active" flag is set, the data exchange between AS-i master and slaves is available in the data exchange phase. If this bit is not set the data exchange is not available. The read ID telegrams are transmitted to the slave.
The bit is set if the AS-i master enters the offline phase.

9.2.2.4 Get Delta List (GET_DELTA)

The delta list contains the list of slave addresses with configuration errors.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	57_{16}							
2	T	0	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	57_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	–
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	57_{16}							
2	T	result						
3	0	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

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9.2.2.5 Get List of Corrupted Slaves (GET_LCS)

The LCS contains the history of the delta list.

With this call, the List of Corrupted Slaves (*LCS*) is read out of the AS-i/PROFIBUS gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	60_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	60_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	60_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

9.2.2.6 Get List of Activated Slaves (GET_LAS)

With this call, the following entry is read out of the AS-i/PROFIBUS gateway: The list of activated slaves (*LAS*).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	45_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	45_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

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Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	45_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

9.2.2.7 Get List of Detected AS-i slaves (GET_LDS)

With this call, the following entry is read out of the AS-i/PROFIBUS gateway: The list of detected AS-i slaves (*LDS*).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	46_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	46_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	46_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

9.2.2.8 Get list of peripheral faults (GET_LPF)

With this call, the list of peripheral faults (*LPF*) signaled by the AS-i slaves is read out from the AS-i master. The LPF is updated cyclically by the AS-i master. If and when an AS-i slave signals faults of the attached peripherals (for example broken wire) can be found in the description of the AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3E_{16}$							
2	T	O	circuit					

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Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3E_{16}$							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3E_{16}$							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

9.2.2.9 Get List of Offline Slaves (GET_LOS)

With this call, the list of slaves causing the offline phase when a configuration error occurs in being read out (List of Offline Slaves, *LOS*).

The user can choose the reaction of the master when a configuration error occurs. The master can be switched off line when an important slave causes a configuration error; less important slaves can send an error to the host, AS-i however will not be switched offline.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	61_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	61_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

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Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	61_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

9.2.2.10 Set List of Off-line Slaves (SET_LOS)

With this call, the list of slaves causing the offline phase when a configuration error occurs in being defined (List of Offline Slaves, *LOS*).

The user can choose the reaction of the master when a configuration error occurs. The master can be switched offline when an important slave causes a configuration error; less important slaves can send an error to the host, AS-i however will not be switched offline.

Request (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	62_{16}							
2	T	O	circuit					
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Request (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	62_{16}							
2	T	1	circuit					
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	62_{16}							
2	T	result						

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9.2.2.11 Get transm.err.counters (GET_TECA)

With this call the error counters of all single slaves/A-slaves can be read (see chapter 7).

With every reading out of the counts, the error counters will be restarted.

The counts are being read out via the corresponding host interface and will be deleted with every read access. The counter´s value is limited to 254. 255 will cause a counter overflow.

The counts could be independent of the counters, which are displayed in the display of the gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	63_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	63_{16}							
2	T	result						
3	APF							
4	slave 1A							
…	…							
34	slave 31A							

9.2.2.12 Get transm.err.counters (GET_TECB)

With this call, the counts of the error counters for B-slaves are being read out (see chapter 7).

With every reading out of the counts, the error counters will be restarted.

The counts are being read out via the corresponding host interface and will be deleted with every read access. The counter´s value is limited to 254. 255 will cause a counter overflow.

The counts could be independent of the counters, which are displayed in the display of the gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	64_{16}							
2	T	–	circuit					

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	64_{16}							
2	T	result						
3	APF							
4	slave 1B							
…	…							
34	slave 31B							

9.2.2.13 GET_TEC_X

Beginning with a definite slave address, the counts of the n error counters are being read out with this call.

With every reading out the counts, the error counters will be restarted.

The counts are being read out via the correspondending host interface and will be deleted with every read access. The counter´s value is limited to 254. 255 will cause a counter overflow.

The counts could be independent of the counters, which are displayed in the display of the gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	66_{16}							
2	T	–	circuit					
3	1. slave address							
4	number of counters							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	66_{16}							
2	T	result						
3	counter 1							
…	…							
n	counter n - 2							

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9.2.2.14 Read Fault Detector (READ_FAULT_DETECTOR)

With with call all informations of the AS-i detector are read aout. In the first byte are stored the values transferred in the moment, in the second all values since the last deleting. By it it is possible to recognize immediate, no more existing before messages also. The second byte is deleted by reading..

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	10_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	10_{16}							
2	T	result						
3	DA	ST	US	ES	reserved			
4	DA	ST	US	ES	reserved			

DA duplicate address

ST noise

US over voltage

ES earth fault

9.2.2.15 Read List of Duplicate Addresses (READ_DUPLICATE_ADDR)

With this call the list of slaves with duplicate addresses (the assignement of one address to two slaves) is read out.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	11_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	11_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

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Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	11_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

9.2.2.16 Functional profiles

Further diagnosis functions for "Safety at Work" and for availability vice versa for warnings of integrated sensors are explained detailed in the chapter "Functional profiles" (chapter 9.2.3).

9.2.3 Functional profiles

9.2.3.1 "Safety at Work" List 1

Function: 00_{16}

List of "safety-directed input slaves" ("AS-Interface Safety at Work"), whose safety function is released.

Safety-directed input slaves have the profile S-7.B or S-0.B (IO = 0 or 7, ID = B, see chapter 9.2.4.4: Read Actual Configuration).

The "Safety at Work" list 1 is a bit list which contains a bit for each possible slave address (1 - 31). This list is written in the bytes 5 until 8 in the response of the command of the command interface. Additionally, the reponse contains the ec-flags of the AS-Interface master in the bytes 3 and 4 (see chapter 9.2.2.3: "Get Flags").

The bits of the "Safety at Work" list 1 are set if the safety function of the slave is activated (e.g. emergency button pressed). The bit is only set at security slaves when both contacts are released, otherwise the bits have the value 0. "Normal" (non-security) slaves also have the value 0.

Since the security monitor is also being activated if a security slave is missing or if the AS-i circuit is shut off (offline active), the ec-flags will also be transmitted. It is sufficient however to monitor the group error message Cok (configuration error). As long as no configuration error, the list of the "safety-directed input slaves" can be used.

Configured safety slaves which are not available, and available slaves sending a wrong coder order, will not be entered in this list.

With the bit "O", the sequence of the bits within the "Safety at Work" list 1 can be chosen.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	O	circuit					
3	00_{16}							

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Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	–							Pok
4	OR	APF	NA	CA	AAv	AAs	S0	Cok
5	7	6	5	4	3	2	1	-
6	15	14	13	12	11	10	9	8
7	23	22	21	20	19	18	17	16
8	31	30	29	28	27	26	25	25

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	–							Pok
4	OR	APF	NA	CA	AAv	AAs	S0	Cok
5	-	1	2	3	4	5	6	7
…	…							
8	24	25	26	27	28	29	30	31

Cok Config_Ok
S0 LDS.0
AAs Auto_Address_Assign
AAv Auto_Address_Available
CA Configuration_Active
NA Normal_Operation_Active
APF APF
OR Offline_Ready
Pok Periphery_Ok

Example for O ≡ 0:

Configuration OK,
periphery OK (no peripheral fault,
2 safety slaves with released safety function,
AS-Inferface addresses 4 and 10
1 safety slave with unreleased safety function,
AS-Inferface address 5.

Reponse: 7E 00 01 25 10 04 00 00

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9.2.3.2 "Safety at Work" Monitor Diagnosis

Function: 02_{16}

Since the "Safety at Work" monitor can make more than 32 Byte diagnosis data, these must be read with several command interface calls. The second request byte declares the start index in the field of the diagnosis data.

If the start index ist 0, new data is fetched from the monitor. Otherwise, the function will respond out of the memory; the data can be read consistently.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	LD	SD	circuit				
3	02_{16}							
4	slave address							
5	index							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	diagnosis byte #index+0							
4	diagnosis byte #index+1							
…	…							
n	diagnosis byte #index+n-3							

LD 1: long diagnosis (enhanced Monitor)
0: short diagnosis

SD 1: unsorted diagnosis (long diagnosis only)
0: sorted diagnosis

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The diagnosis data field of the safety monitor is structured as follows (short diagnosis):

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	00_{16}							
1	monitor state							
2	state circuit 1							
3	state circuit 2							
4	number circuit 1							
5	number circuit 2							
6	device index 32, circuit 1							
7	device color, circuit 1							
8	device index 33, circuit 1							
9	device color, circuit 1							
…	…							
68	device index 63, circuit 1							
69	device color, circuit 1							
70	device index 32, circuit 2							
71	device color, circuit 2							
…	…							
132	device index 63, circuit 2							
133	device color, circuit 2							

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The diagnosis data field of the safety monitor is structured as follows (long diagnosis):

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	00_{16}							
1	monitor state							
2	state circuit 1							
3	state circuit 2							
4	number circuit 1							
5	number circuit 2							
6	device Index 32, circuit 1							
7	device color, circuit 1							
…	…							
132	device Index 95, circuit 1							
133	device color, circuit 1							
134	device Index 32, circuit 2							
135	device color, circuit 2							
…	…							
260	device Index 95, circuit 2							
261	device color, circuit 2							

9.2.3.3 Integrated AS-i Sensors: Warnings

Function: 03_{16}

List of integrated AS-i sensors according to profile S-1.1 (without extended addressing) or profile S-3.A.1(with extended addressing), by which the input data bit D1 ("Warning") being deleted.

For creating of this list CDI and IDI are used only. Integrated AS-i slaves which are projected but not existing therefore are not entered here.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	O	circuit					
3	03_{16}							

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Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	0	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24A	25A	26A	27A	28A	29A	30A	31A

9.2.3.4 Integrated AS-i Sensors: Availability

Function: 04_{16}

List of the integrated slaves according to profile S-1.1 whose input data bits D2 ("Availability") are deleted.

For creating this list, CDI and IDI are used only. Integrated AS-i slaves which are projected but not existing therefore are not entered here.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	O	circuit					
3	04_{16}							

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	7	6	5	4	3	2	1	0
…	…							
6	31	30	29	28	27	26	25	24

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Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	0	1	2	3	4	5	6	7
…	…							
6	24	25	26	27	28	29	30	31

9.2.4 Configuration of the AS-i Master

9.2.4.1 Overview of the Commands

Values for command				
comamnd	value	meaning	Req Len	Res Len
SET_OP_MODE	$0C_{16}$	Set_Operation_Mode	3	2
STORE_CDI	07_{16}	Store_Actual_Configuration	2	2
READ_CDI	28_{16}	Read_Actual_Configuration	3	4
SET_PCD	25_{16}	Set_Permanent_Config	5	2
GET_PCD	26_{16}	Get_Permanent_Config	3	4
SET_LPS	29_{16}	SET_LPS	11	2
GET_LPS	44_{16}	Get_LPS	2	10
STORE_PI	04_{16}	Store_Actual_Parameter	2	2
WRITE_P	02_{16}	Write_Parameter	4	3
READ_PI	03_{16}	Read_Parameter	3	3
SET_PP	43_{16}	Set_Permanent_Parameter	4	2
GET_PP	01_{16}	Get_Permanent_Parameter	3	3
SET_AAE	$0B_{16}$	Set_Auto_Adress_Enable	3	2

9.2.4.2 Set Operation Mode (SET_OP_MODE: Set_Operation_Mode)

This call switches between configuration mode and protected mode.

In protected mode, only AS-i slaves entered in the LPS and whose expected and actual configurations match, are being activated.

In other words: The slaves are being activated if the I/O configuration and the ID codes of the detected AS-i slaves are identical to the configured values.

In configuration mode, all detected AS-i slaves (except for AS-i slave "0") are activated. This also applies to AS-i slaves for which there are differences between the expected and actual configuration.

The “OPERATION MODE” bit is stored permanently; in other words, it is retained after a cold/warm restart.

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When you change from configuration mode to protected mode, the AS-i master will do a warm restart (change to the offline phase followed by a change to the online mode).

Note

If an AS-i slave with address "0" is entered in the LDS, the AS-i/PROFIBUS gateway cannot change from configuration mode to protected mode.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0C_{16}$							
2	T	–	circuit					
3	operation mode							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0C_{16}$							
2	T	result						

Meaning of bit operation mode:

0 = protected mode
1 = configuration mode

9.2.4.3 Store Actual Configuration (STORE_CDI)

With this call, the (actual) configuration data (I/O configuration, ID code, extended ID1 code and extended ID2 code) of all AS-i slaves are stored permanently in the EEPROM as the (expected) configuration data. The list of activated AS-i slaves (*LAS*) is adopted in the list of permanent AS-i slaves (*LPS*).

When this command is executed, the AS-i master changes to the offline phase and then changes back to the normal mode (warm restart on the AS-i master).

This command can only be executed in the configuration mode.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	07_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	07_{16}							
2	T	result						

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9.2.4.4 Read Actual Configuration (READ_CDI)

With this call, the following configuration data of an addressed AS-i slave obtained by the AS-i master on the AS-Interface are read.

- I/O configuration
- ID code
- Extended ID1 code
- Extended ID2 code

The configuration data are specified by the manufacturer of the AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	28_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	28_{16}							
2	T	result						
3	xID2				xID1			
4	ID				I0			

Meaning of bit B:

B = 0 Single AS-i slave or A-slave
B = 1 B-slave

9.2.4.5 Set Permanent Configuration (SET_PCD)

This call sets the following configuration data for the addressed AS-i slave:

- I/O configuration
- ID code
- Extended ID1 code
- Extended ID2 code

The configuration data are stored permanently on the EEPROM of the AS-i/PROFIBUS gateway and are used as the expected configuration by the AS-i master in the protected mode. The configuration data are specified by the manufacturer of the AS-i slave.

If the addressed AS-i slave does not support an extended ID code 1/2, the value F_{hex} must be specified.

When this command is executed, the AS-i master changes to the offline phase and then changes back to the normal mode (warm restart).

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This command can only be executed in the configuration mode.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	25_{16}							
2	T	–	circuit					
3	–		B	slave address				
4	xID2				xID1			
5	ID				I0			

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	25_{16}							
2	T	result						

Meaning of bit B:

B = 0 Single AS-i slave or A-slave

B = 1 B-slave

9.2.4.6 Get Extended Permanent Configuration (GET_PCD)

This call reads the following configuration data (configured data) of an addressed AS-i slave stored on the EEPROM of the AS-i master:

- I/O configuration
- ID code
- Extended ID1 code
- Extended ID2 code

The configuration data are specified by the manufacturer of the AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	26_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	26_{16}							
2	T	result						
3	xID2				xID1			
4	ID				I0			

Meaning of bit B:

B = 0 Single AS-i slave or A-slave

B = 1 B-slave

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9.2.4.7 Set List of Projected Slaves (SET_LPS)

With this call, the list of configured AS-i slaves is transferred for permanent storage in the EEPROM of the master.

When this command is executed, the AS-i master changes to the offline phase and then changes back to the normal mode (warm restart).

This command can only be executed in the configuration mode.

Request (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	29_{16}							
2	T	0	circuit					
3	00_{16}							
4	7A	6A	5A	4A	3A	2A	1A	–
…	…							
11	31B	30B	29B	28B	27B	26B	25B	24B

Request (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	29_{16}							
2	T	1	circuit					
3	00_{16}							
4	–	1A	2A	3A	4A	5A	6A	7A
…	…							
11	24B	25B	26B	27B	28B	29B	30B	31B

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	29_{16}							
2	T	result						

9.2.4.8 Get List of Projected Slaves (GET_LPS)

With this call, the following entry is read out of the AS-i/PROFIBUS gateway: The list of projected AS-i slaves (*LPS*).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	44_{16}							
2	T	O	circuit					

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Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	44_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	44_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

9.2.4.9 Store Actual Parameters (STORE_PI)

With this call, the configured parameters stored on the EEPROM are overwritten with the current, permanently stored (actual) parameters; in other words, the current parameters of all AS-i slaves are stored.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	04_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	04_{16}							
2	T	result						

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9.2.4.10 Write Parameter (WRITE_P)

The AS-i slave parameter value transferred with the command is passed on to the addressed AS-i slave.

The parameter is stored in the AS-i/PROFIBUS gateway only temporarily and is not stored as a configured parameter in the EEPROM!

The AS-i slave transfers its current parameter value in the response (parameter echo). This can deviate from the value that has just been written according to the AS-i master specification.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	02_{16}							
2	T	–	circuit					
3	–		B	slave address				
4	–				parameter			

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	02_{16}							
2	T	result						
3	–				slave response			

Meaning of bit B:

B = 0 Single AS-i slave or A-slave

B = 1 B-slave

9.2.4.11 Read Parameter (READ_PI: Read_Parameter)

This call returns the current parameter value (actual parameter) of an AS-i slave sent by the AS-i/PROFIBUS gateway. This value must not be confused with the parameter echo that is supplied by the AS-i slave as a response to the write_p job.

This command can not be used for a directly reading of an AS-i parameter out of an AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	03_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	03_{16}							
2	T	result						
3	–				PI			

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Meaning of bit B:

B = 0 Single AS-i slave or A-slave

B = 1 B-slave

9.2.4.12 Set_Permanent_Parameter (SET_PP)

With this call, a parameter value for the specified AS-i slave is configured. The value is stored permanently in the EEPROM of the gateway.

The configured parameter value is transferred only when the AS-i slave is activated after turning on the power supply on the AS-i/PROFIBUS gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	43_{16}							
2	T	–	circuit					
3	–		B	slave address				
4	–				PP			

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	43_{16}							
2	T	result						

9.2.4.13 Get_Permanent_Parameter (GET_PP)

With this call, a slave-specific parameter value stored on the EEPROM of the AS-i/PROFIBUS gateway is read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	01_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	01_{16}							
2	T	result						
3	–				PP			

Meaning of bit B:

B = 0 Single AS-i slave or A-slave

B = 1 B-slave

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9.2.4.14 Set Auto Address Enable (SET_AAE)

This call can enable or disable the "automatic address programming" function.

The AUTO_ADDR_ENABLE bit is stored permanently; in other words, it is retained after a warm/hot restart on the AS-i master.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0B_{16}$							
2	T	–	circuit					
3	Auto_Address_Enable							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0B_{16}$							
2	T	result						

9.2.5 Other Commands

9.2.5.1 Overview of the Commands

Value for command				
command	value	meaning	Req Len	Res Len
IDLE	00_{16}	No request	2	2
READ_IDI	41_{16}	Read IDI	2	36
WRITE_ODI	42_{16}	Write_ODI	34	2
READ_ODI	56_{16}	Read ODI	2	34
SLAVE_ADDR	$0D_{16}$	Change_Slave_Address	4	2
WRITE_XID1	$3F_{16}$	Write_Extended_ID-Code_1	3	2
SET_OFFLINE	$0A_{16}$	Set_Off-Line_Mode	3	2
SET_DATA_EX	48_{16}	Set_Data_Exchange_Active	3	2
BUTTONS	75_{16}	Disable Pushbuttons	3	2
FP_PARAM	$7D_{16}$	„Functional Profile“ Param.	≥3	≥2
FP_DATA	$7E_{16}$	„Functional Profile“ Data	≥3	≥2
EXT_DIAG	71_{16}	ExtDiag generation	6	2
RD_EXT_DIAG	$7B_{16}$	Read ExtDiag Settings	2	7
INVERTER	$7C_{16}$	Configure Inverter Slaves	12	4

9.2.5.2 IDLE

When the value of "command" is zero, no request will be fulfilled.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	00_{16}							
2	T	–	circuit					

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	00_{16}							
2	T	result						

9.2.5.3 Read Input Data Image (READ_IDI)

With this call, the input data values of all AS-i slaves are read out of the AS-i/PROFIBUS gateway in addition to the cyclic data exchange. Though the command READ_IDI transmits all execution control flags (byte 3 and byte 4).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	41_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	41_{16}							
2	T	result						
3	–							Pok
4	OR	APF	NA	CA	AAv	AAs	s0	Cok
5	–				slave 1A			
6	slave 2A				slave 3A			
…	…							
36	slave 30B				slave 31B			

Pok Periphery_Ok
S0 LDS.0
AAs Auto_Address_Assign
AAv Auto_Address_Available
CA Configuration_Active
NA Normal_Operation_Active
APF APF
OR Offline_Ready
Cok Config_Ok

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9.2.5.4 Write Output Data Image (WRITE_ODI)

With this call the output data values of all AS-i slaves are written in additon to the cyclic data exchange.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	42_{16}							
2	T	–	circuit					
3	–				slave 1A			
4	slave 2A				slave 3A			
…	…							
34	slave 30B				slave 31B			

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	42_{16}							
2	T	result						

9.2.5.5 Read Output Data Image (READ_ODI)

With this call, the output data values of all AS-i slaves is being read out of the AS-i/PROFIBUS gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	56_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	56_{16}							
2	T	result						
3	–				slave 1A			
	slave 2A				slave 3A			
…	…							
34	slave 30B				slave 31B			

9.2.5.6 Change Slave Address (SLAVE_ADDR)

With this call, the AS-i address of an AS-i slave can be modified.

This call is mainly used to add a new AS-i slave with the default address "0" to the AS-Interface. In this case, the address is changed from "AS-i slave address old" = 0 to "AS-i slave address new".

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This change can only be made when the following conditions are fulfilled:

1. An AS-i slave with “AS-i slave address old” exists.
2. If the old AS-i slave address is not equal to 0, an AS-i slave with address "0" cannot be connected at the same time.
3. The "AS-i slave address new" must have a valid value.
4. An AS-i slave with "AS-i slave address new" must not exist.

Note

When the AS-i slave address is changed, the AS-i slave is not reset, in other words, the output data of the AS-i slave are retained until new data are received at the new address.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0D_{16}$							
2	T	–	circuit					
3	–		B	source address				
4	–		B	target address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0D_{16}$							
2	T	result						

Meaning of bit B:

B = 0 Single AS-i slave or A-slave

B = 1 B-slave

9.2.5.7 Write AS-i Slave Extended ID1 (WRITE_XID1)

With this call, the extended ID1 code of an AS-i slave with address "0" can be written directly via the AS-i cable. The call is intended for diagnostic purposes and is not required in the normal master mode.

The AS-i master passes the extended ID1 code on to the AS-i slave without any plausibility check.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3F_{16}$							
2	T	–	circuit					
3	–				xID1			

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Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3F_{16}$							
2	T	result						

9.2.5.8 Set Offline Mode (SET_OFFLINE)

This call switches between online and offline mode.

The online mode is the normal operating state for the AS-i master. The following jobs are processed cyclically:

- During the data exchange phase, the fields of the output data are transferred to the slave outputs for all AS-i slaves in the LAS. The addressed AS-i slaves submit the values of the slave inputs to the master when the transfer was free of errors.
- This is followed by the inclusion phase in which existing AS-i slaves are searched and newly added AS-i slaves are entered in the LDS or LAS.
- In the management phase, jobs by the user such as writing parameters are executed.

In the offline mode, the AS-i/PROFIBUS gateway processes jobs by the user only. (Jobs that involve the immediate addressing of an AS-i slave are rejected with an error). There is no cyclic data exchange with the AS-i slaves.

When offline, the AS-i circuit is in a safe state.

The OFFLINE = TRUE bit is not permanently stored; in other words, following a cold/warm restart, the AS-i/PROFIBUS gateway is once again in the online mode.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0A_{16}$							
2	T	–	circuit					
3	Off-Line							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0A_{16}$							
2	T	result						

The master changes to the offline phase, if there is a 1 written in byte 3.

The master will change to online mode if there is a 0 written in byte 3.

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9.2.5.9 Release Data Exchange (SET_DATA_EX)

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	48_{16}							
2	T	–	circuit					
3	Data_Exchange_Active							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	48_{16}							
2	T	result						

9.2.5.10 BUTTONS

With this call, the use of the buttons can be enabled/disabled.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	75_{16}							
2	T	–	circuit					
3	ButtonsDisabled							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	75_{16}							
2	T	result						

9.2.5.11 FP_PARAM

This command is used for parametrization of "functional profiles".

The content of the request and response bytes depends on the called function (see chapter 9.2.3).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	–	circuit					
3	function							
4	request byte 1							
…	…							
n	request byte n-3							

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	result						
3	response byte 1							
…	…							
n	response byte n-2							

9.2.5.12 FP_DATA

This command is used for the data exchange with "functional profiles".

The content of the request and response bytes depends on the called function (see chapter 9.2.3).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	–	circuit					
3	function							
4	request byte 1							
…	…							
n	request byte n-3							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	reponse byte 1							
…	…							
n	response byte n-2							

9.2.5.13 EXT_DIAG

With this call, the conditions when to set the ExtDiag bit can be selected.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	71_{16}							
2	T	–	circuit					
3	CF							
4	APF							
5	PF							
6	CS							

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	71_{16}							
2	T	result						

CF ExtDiag is set, if ConfigError ≡ 1
APF ExtDiag is set, if APF ≡ 1
PF ExtDiag is set, if PeripheryFault ≡ 1
CS ExtDiag is set, if LCS is not empty

9.2.5.14 RD_EXT_DIAG

With this call, the conditions when the ExtDiag bit is set can be read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7B_{16}$							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	75_{16}							
2	T	result						
3	CF							
4	APF							
5	PF							
6	CS							
7	FD							

CF ExtDiag is set by ConfigError ≡ 1
APF ExtDiag is set by APF ≡ 1
PF ExtDiag is set by PeripheryFault ≡ 1
CS ExtDiag is set, if LCS is not empty
FD Diagnosis will be updated only if this is dictated by the PROFIBUS norm. Diagnosis date are not up to date when in doubt.

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9.2.5.15 INVERTER

With this call, an AS-i slave for frequency inverters is switched from cyclical mode to the transmission mode of four 16 bit values, in order to operate again with the selected AS-i destination parameter.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7C_{16}$							
2	T	–	circuit					
3	slave address							
4	destination parameter							
5	value 1, high byte							
6	value 1, low byte							
7	value 2, high byte							
8	value 2, low byte							
9	value 3, high byte							
10	value 3, low byte							
11	value 4, high byte							
12	value 4, low byte							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7C_{16}$							
2	T	result						

9.3 Command Interface Examples

9.3.1 Reading analog Input Values

Command RD_7X_IN: Reading of analog input values.

PROFIBUS DP V0: cyclic data exchange

Used ID/module in the GSD file: 12 bytes management

Meaning of the bytes:

Request: RD_7X_IN	
Byte 1	50_{hex} (RD_7X_IN)
Byte 2	00_{hex} (master 1, single master)
Byte 3	$1D_{hex}$ (slave address 29)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

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Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The call of the command interaface has not been answered with the valid values since the toggle bit has not been set.

Set of toggle bit:

Request	
Byte 1	50_{hex}
Byte 2	80_{hex} (toggle bit, result)
Byte 3	$1D_{hex}$ (slave address 29)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Result: See chapter 9.1.2 "Values for Results"

Response	
Byte 1	50_{hex}
Byte 2	80_{hex} (toggle bit, master1)
Byte 3	analog channel 1 high $byte_{hex}$
Byte 4	analog channel 1 low $byte_{hex}$
Byte 5	analog channel 2 high $byte_{hex}$
Byte 6	analog channel 2 low $byte_{hex}$
Byte 7	analog channel 3 high $byte_{hex}$
Byte 8	analog channel 3 low $byte_{hex}$
Byte 9	analog channel 4 high $byte_{hex}$
Byte 10	analog channel 4 low $byte_{hex}$
Byte 11	00_{hex} not used
Byte 12	00_{hex} not used

To get the input data again, the T-bit has to be reset again. If a command of the command interface with DP V1 is being carried out, setting the toggle bit is not necessary.

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9.3.2 Store current Configuration to the AS-i Master

1. Switch master to configuration mode
2. Write the current slave configuration to the master
3. Switch master to protected mode
4. Wait until master is in normal (protected) operation mode

12 Byte Management

1. Switch master to config mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the Toggle Bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

Master is now in configuration mode.

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Result = 0 ⇒ No error, for other result codes see chapter 9.1.2 "Values for Results".

2. Write the actual slave configuration to the master

Request: STORE_CDI	
Byte 1	07_{hex} (STORE_CDI)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the toggle bit:

Request: STORE_CDI	
Byte 1	07_{hex} (STORE_CDI)
Byte 2	80_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex}
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The current configuration data has been written.

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3. Set master to protected mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the toggle bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The master has now been ordered to switch to protected mode. It must being watited until the master is switching in this operation mode.

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4.Wait until master is in normal operation mode (and protected mode)

Reading out the flags until NA (Normal Operation Active) has been set.

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response								
Byte 1	47_{hex}							
Byte 2	80_{hex} (T = 1, result = 0)							
Byte 3	-	-	-	-	-	-	-	POK
Byte 4	OR	APF	NA	CA	AAv	AAs	S0	COK
Byte 5						AAe	OL	DX
Byte 6	00_{hex}							
…								
Byte 12	00_{hex}							

The flag NA has to be set before the application is started. In case it is not set, the flags have to be read out until this flag has been set to 1.

The flag NA indicates that the master is in normal operation mode.

Normal operation mode is necessary to run the application safely.

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9.3.3 Store new Configuration for all Slaves

1. Switch master in configuration mode
2. Write slave configuration to master
3. Write new list of projected slaves (*LPS*)
4. Write permanent parameter (*PP*) to master
5. Switch master to protected mode
6. Wait until master is in normal operation Mode (and protected mode)

12 Byte Management

1. Set master in config mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the toggle bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

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Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The master is now in configuration mode.

Result: See chapter 9.1.2 "Values for Results".

2. Write single configuration to master

Writing a configuration of an AS-i slave to the master.

For example:

Analog input 4 CH at address 4 (Slave datasheet)
ID: 3_{hex}
ID2: E_{hex}
IO: 7_{hex}
ID1: F_{hex}

Request: SET_PCD	
Byte 1	25_{hex} (SET_PCD)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	EF_{hex} (ID + IO to configurate)
Byte 5	37_{hex} (xID2 + xID1 to configurate)
Byte 6	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

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Set the toggle bit:

Request: SET_PCD	
Byte 1	$0C_{hex}$ (SET_PCD)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	EF_{hex} (ID + IO to configurate)
Byte 5	37_{hex} (ID + IO to configurate)
Byte 6	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	25_{hex}
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The single slave configuration for the analog module is written.

This command must be repeated for all 31 A-slaves and all 31 B-slaves. If you don't connect a slave to an address, write F_{hex} for ID, IO, ID1, ID2.

3. Write new list of projected slaves

Write the complete LPS of your AS-i circuit.

Every bit in the LPS corresponds to one slave after the following scheme:

Byte0/Bit 0: slave 0/0A - can not be set!
Byte1/Bit 1: slave 1/1A
...
Byte3/Bit 7: slave 31/31A
Byte4/Bit 0: slave 0B - can not be set!
Byte4/Bit 1: slave 1B
...

Byte7/Bit 7: slave 31B
The slave is projected if the bit is set.

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Example above: Analog module at address 4 ⇒ Set bit 4/byte 0:

Request: SET_LPS	
Byte 1	29_{hex} (SET_LPS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
Byte 4	10_{hex} (LDS byte 0)
Byte 5	00_{hex} (LDS byte 1)
…	…
Byte 11	00_{hex} (LDS byte 7)
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: SET_LPS	
Byte 1	29_{hex}
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	00_{hex}
Byte 4	10_{hex} (LDS byte 0)
Byte 5	00_{hex} (LDS byte 1)
…	…
Byte 11	00_{hex} (LDS byte 7)
Byte 12	00_{hex}

Response	
Byte 1	29_{hex}
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The new list of protected slaves (LPS) is written.

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4. Write permanent parameter (power on parameter) to master

Example as above:Analog module at address 4 with PP = 07_{hex}

Request: SET_PP	
Byte 1	43_{hex} (SET_PP)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	07_{hex} (PP to write (use low nibble))
Byte 5	00_{hex} (LDS byte 1)
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0

Setting the toggle bit:

Request: SET_PP	
Byte 1	43_{hex} (SET_PP)
Byte 2	80_{hex} (T = 0, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	07_{hex} (PP to write (use low nibble)
Byte 5	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	43_{hex}
Byte 2	80_{hex} (T = 1, Result = 0)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

The permanent parameter for the analog module is written.

This command must be repeated for all 31 A-slaves and all 31 B-slaves. If you don't connect a slave to an address, write the default value to the master (F_{hex}) as a permanent parameter.

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5. Switch Master to Protected Mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The master has now been ordered to switch to protected mode.

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6. Wait until master is in normal (protected) operation mode

Read out the flags, until the NA (Normal Operation Active) has been set.

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response								
Byte 1	47_{hex}							
Byte 2	80_{hex} (T = 1, result = 0)							
Byte 3	-	-	-	-	-	-	-	POK
Byte 4	OR	APF	NA	CA	AAv	AAs	S0	COK
Byte 5						AAe	OL	DX
Byte 6	00_{hex}							
…								
Byte 12	00_{hex}							

The flag NA has to be set before the application is started. In case it is not set, the flags have to be read out until this flag has been set to 1.

The flag NA indicates that the master is in normal operation mode.

Normal operation mode is necessary to run the application safely.

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If a command of the command interface is used via PROFIBUS DP V1, it is not necessary to use the toggle bit.

The flag NA indicates that the master is in the normal operating mode which is necessary for the application to run safely.

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10 Commissioning Tools and Accessories

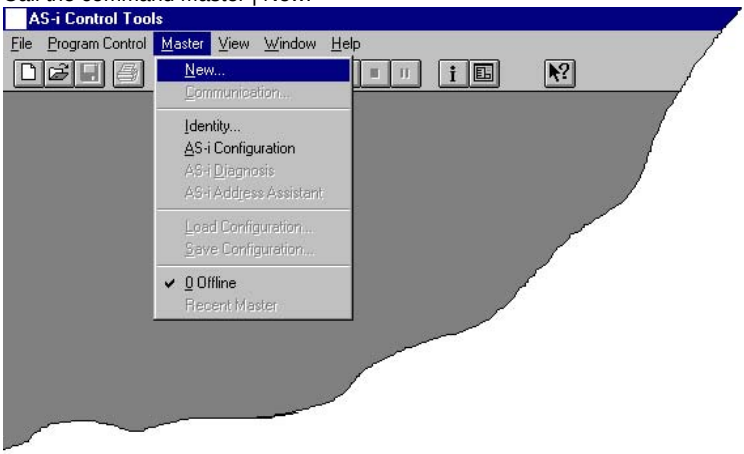
The AS-i circuit on the AS-i/PROFIBUS gateway can be put into operation comfortably with the Windows software "AS-i Control Tools" (art. no. 55717).

This software communicates with the AS-i/PROFIBUS gateway by means of a PROFIBUS DP master simulator DP V1 (art. no. 556617).

10.1 Windows Software AS-i Control Tools

The Windows software AS-i Control Tools enables you to configure the AS-i circuit in a very comfortable manner.

1. For this purpose plug in a Bihl+Wiedemann PROFIBUS DP Master Simulator DP V1 to the D-SUB-connector of the AS-i/PROFIBUS gateway and connect the device with a fully covered cable to the serial interface of your PC.
2. Start the AS-i Control Tools.
3. Call the command Master | New.



4. Choose PROFIBUS as protocol.

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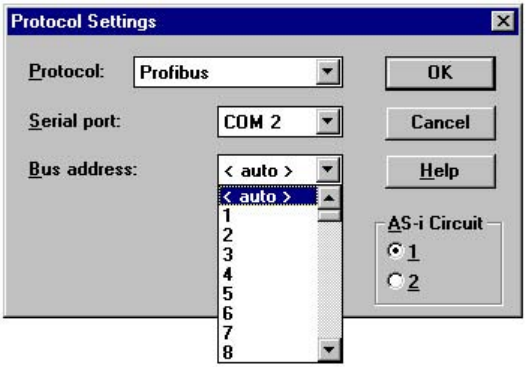
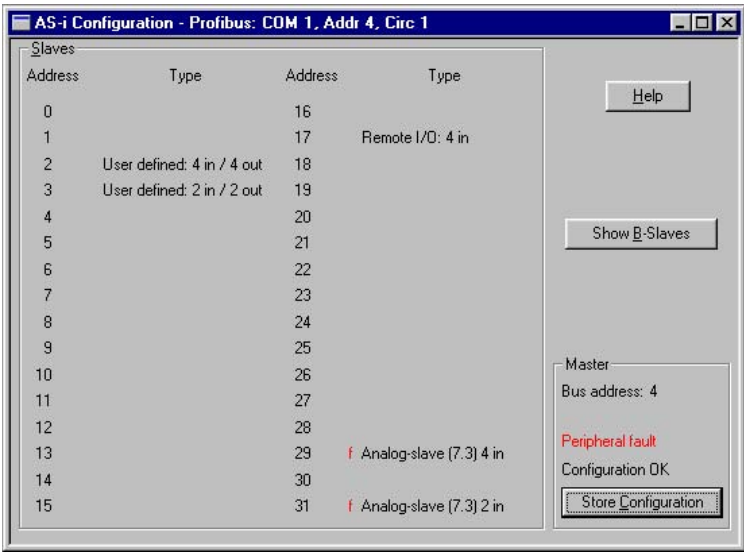
5. Do the appropriate settings. (e.g. serial interface COM 2, station address <auto>, AS-i circuit 1)



6. Call the command Master | AS-i configuration.
   The AS-i configuration editor will be started. All detected and projected AS-i slaves are displayed in this window.



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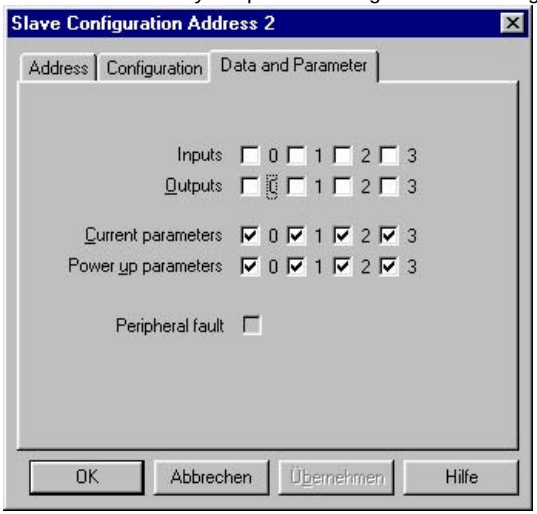
7. Click on a slave entry to open the dialog box slave configuration.



Changing a slave address, setting AS-i parameters or AS-i configuration data is possible here. Additionally, inputs and outputs can be tested.

A very easy approach to configure the AS-i circuit is connecting each AS-i slave to the line and setting the AS-i slave address one after the other. After that press the button “Store configuration” to adopt the detected AS-i circuit to the AS-i master as projected data.

Furthermore you can use the **AS-i Address Assistant**. This tool automatically changes the address of an AS-i slave to the desired address after connecting the slave to the AS-i line. The desired AS-i configuration can be created ooffline before and then be stored to a file. When building up the plant you only have to connect the AS-i slaves to the AS-i line one after the other.

Further descriptions to all features of the software can be obtained from the integrated help.

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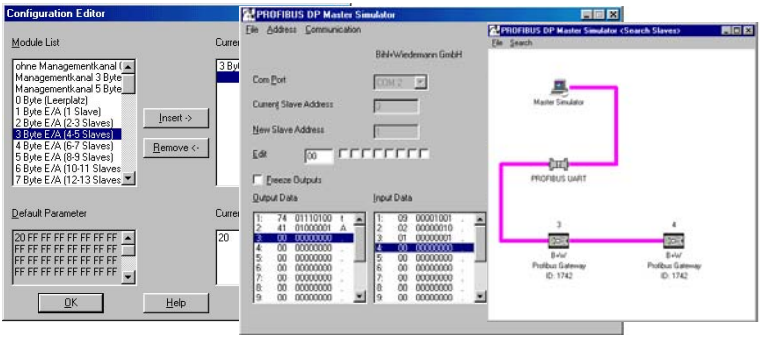
10.2 PROFIBUS DP Master Simulator



The PROFIBUS DP Master Simulator is an easy to use software for data exchange with PROFIBUS slaves of almost all manufacturers via PROFIBUS DP. The PROFIBUS DP master simulator can exchange data with many PROFIBUS slaves even without GSD file or type-file. The PROFIBUS slaves can be put into operation with the default I/O window. Input data can be read and output data can be written. Furthermore, the PROFIBUS DP Master Simulator also processes GSD-files. User parameters can be edited and the configuration can be modified and stored. The PROFIBUS station address can be changed with the PROFIBUS DP master simulator as well, this is useful for PROFIBUS I/O modules in protection class IP67 without addressing switches.

The PROFIBUS DP Master Simulator offers the possibility to scan a PROFIBUS network for connected slaves and and to display them graphically. In this case, the case the PROFIBUS UART has to be connected directly to a PROFIBUS slave. The I/O data and the PROFIBUS user diagnosis can be displayed binary, hexdecimal and now also as ASCII code. The PROFIBUS output data can be transmitted consistently to the PROFIBUS slave. In **type mode** it is possible to set an output as long as the mouse button is pressed.

The new version of the PROFIBUS DP Master Simulator (article no. 22419) supports PROFIBUS DP V1. PROFIBUS slaves can be operated in the acyclic mode DP V1. This is especially helpful for commissioning complex field devices like drives, modular I/O systems etc.

The PROFIBUS Master Simulator consists of the software and the **PROFIBUS UART** which is the ideal interface converter between the RS 232 interface of a PC and the PROFIBUS slave. The **UART** does not need any additional external power supply. Therefore it is also suitable for mobile use with a laptop or a notebook. The **PROFIBUS UART** is simply inserted between the PROFIBUS slave and the RS 232 connector cable.

Besides the software "PROFIBUS DP master simulator", **DLL drivers** for Windows98, Windows Me, Windows 2000 and Windows NT as well as examples written in C come with the PROFIBUS UART. This offers the possibility to **use the PROFIBUS UART in combination with an own software**. However the PROFIBUS UART is a monitoring and commissioning tool for PROFIBUS slaves, it is not designed to control automation processes.

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11 Appendix: Codes indicated by the Display

In the basic state of the configuration mode, the display shows the addresses of all detected slaves at a rate of two per second one after the other. A blank display indicates that the *LDS* is empty, no slaves were detected.

In the basic state of the protected operating mode, the display is either blank or displays the address of a faulty assignment (see chapter 5.4.2).

During manual address programming, the slave address display has a different meaning (see chapter 5.5 and 5.6).

All displayed numbers bigger than 31 which can not be interpreted as a slave address are status or error messages of the master. They have the following meanings:

39	Advanced AS-i diagnostics: After pressing the 'set'-button a short-time AS-i power failure occured.
40	The AS-i master is in offline phase.
41	The AS-i master is in detection phase.
42	The AS-i master is in activation phase.
43	The AS-i master starts the normal operating mode.
70	Hardware error: The AS-i master's EEPROM cannot be written.
72	Hardware error: The PIC processor does not respond.
73	Hardware error: The PIC processor does not respond.
74	Checksum error in the EEPROM.
75	Error in the internal RAM.
76	Error in the external RAM.
77	AS-i control software error: Stack overflow (AS-i control II)
78	AS-i control software error: Checksum error in the control program.
80	Error while attempting to exit the configuration mode: A slave with address zero exists.
81	General error while changing a slave address.
82	The front panel operation is blocked. Until repowering-up the device can only be accessed from the host via the interface.
83	Program reset of the AS-i Control programm: The AS-i Control programm is being read out of EEPROM and copied into the RAM.
88	Display test while starting up the AS-i master
90	Error while changing a slave address in protected operating mode: No slave with address 0 existing.
91	Error while changing slave address: Target address is already used.
92	Error while changing slave address: New address could not be set.
93	Error while changing slave address: New address could only be stored volatilely in the slave.
94	Error while changing the slave address in protected operating mode: Slave has wrong configuration data.

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95	Error while changing slave address in protected operating mode: The configuration error was caused by a superfluous slave (instead of a missing slave).

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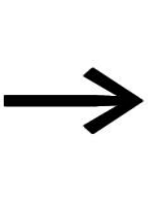
12 Appendix: Installation/Commissioning Instructions

12.1 Installation/Commissioning Instruction AS-i/PROFIBUS Gateway Article Number 556612

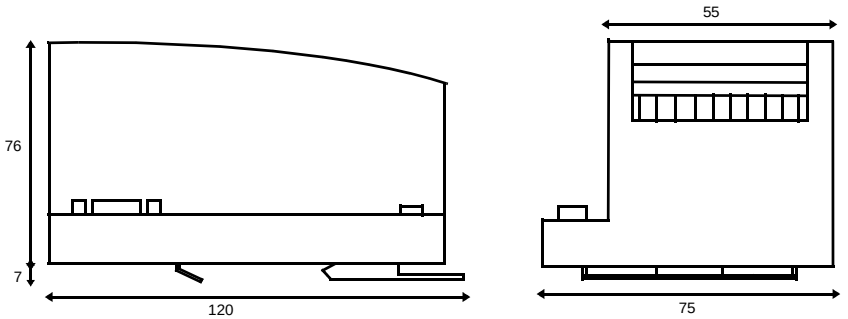
AS-i/PROFIBUS Gateway in Stainlees Steel Art. No.



Dokumentation AS-Interface/PROFIBUS-Gateways (**deutsch**) **556615**

Documentation AS-Interface/PROFIBUS-Gateways (**english**) **556615**

Dimensions [mm]



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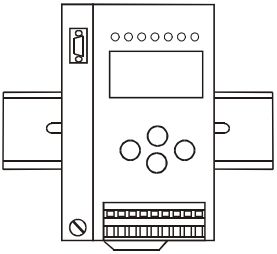
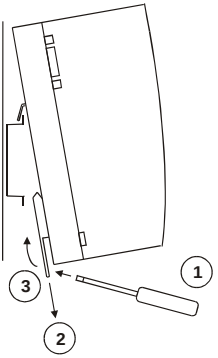
Montage

on mounting plate with 35 mm top-hat rail ①





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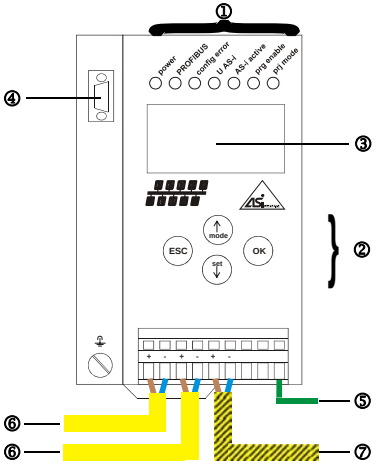
Front View and Connections



⑥ AS-i-Kreis/AS-i circuit/Bus AS-i/AS-i Circuito/AS-i Circuito
⑦ AS-i-Netzteil/AS-i power supply/Alimentation bus/Alimentazione AS-i/Alimentación AS-i

Hinweis/Hint/Remarque/Indicazione/Nota

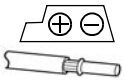
Am Kabel für das Netzteil dürfen keine Slaves oder Repeater angeschlossen werden.
Am Kabel für den AS-i-Anschluss dürfen keine AS-i-Netzteile oder weitere Master angeschlossen werden.

At the cable for power supply no slaves or repeaters may be attached.
At the cable for AS-i circuit no power supplies or further masters may be attached.

Au câble pour l'alimentation aucun esclave ou répéteur peut ne pas être attaché.
Au câble pour le circuit AS-i aucune alimentation ou autre maître ne peut être attachée

Al cavo per il alimentazione nessun schiavi o ripetitore possono essere fissati.
Al cavo per il AS-i circuito nessun alimentazione o ulteriore padrone possono essere fissati.

En el cable para l´alimentación ningunos esclavos o repetidores pueden ser unidos.
En el cable para el AS-i circuito ningunas alimentación u otros amos pueden ser unidos.



Temperature rating for cable: 60/75°C
Use copper conductors only

1 x 0.5 - 1.5 mm² (16AWG)

Operating temperature: 0°C … +55°C
Tightening torque: 7 pound inches

① LED-Statusanzeige
② Tasten für Handbedienung
③ LCD-Anzeige
④ PROFIBUS-Anschluss
⑤ Erde
⑦ Stromversorgung
⑥ AS-Interface-Anschluss

① LED status display
② Buttons for hand operation
③ LCD display
④ PROFIBUS connection
⑤ Earth
⑦ Power supply f
⑥ AS-interface connection

① Afficheur d'état DEL
② Boutons pour commande manuelle
③ Afficheur LCD
④ Raccordement PROFIBUS
⑤ Terre
⑦ Alimentation
⑥ Connexion AS-Interface

① Visualizzazione a LED
② Pulsanti per le impostazioni manuali
③ Indicazione LCD
④ Collegamento PROFIBUS
⑤ Terra
⑦ Alimentazione
⑥ Collegamento interfaccia AS-Interface

① LED visualización
② Teclas para accionamiento manual
③ Indicación LCD
④ Conexión PROFIBUS
⑤ Tierra
⑦ Alimentación eléctrica
⑥ Conexión AS-Interface

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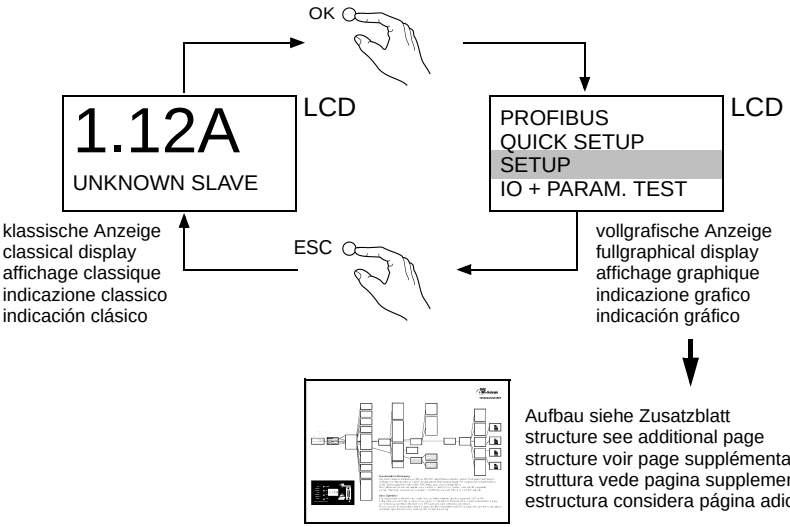
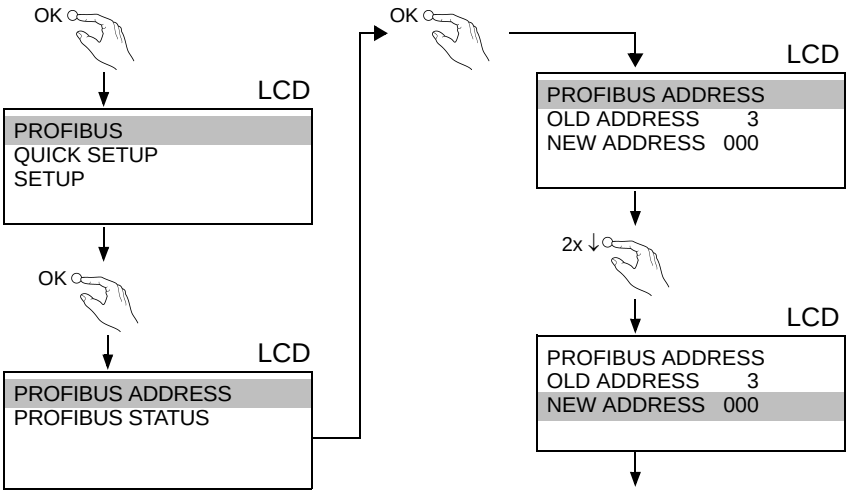
1. Startup

1.1 Fullgraphical Display



1.2 Setting the PROFIBUS DP address



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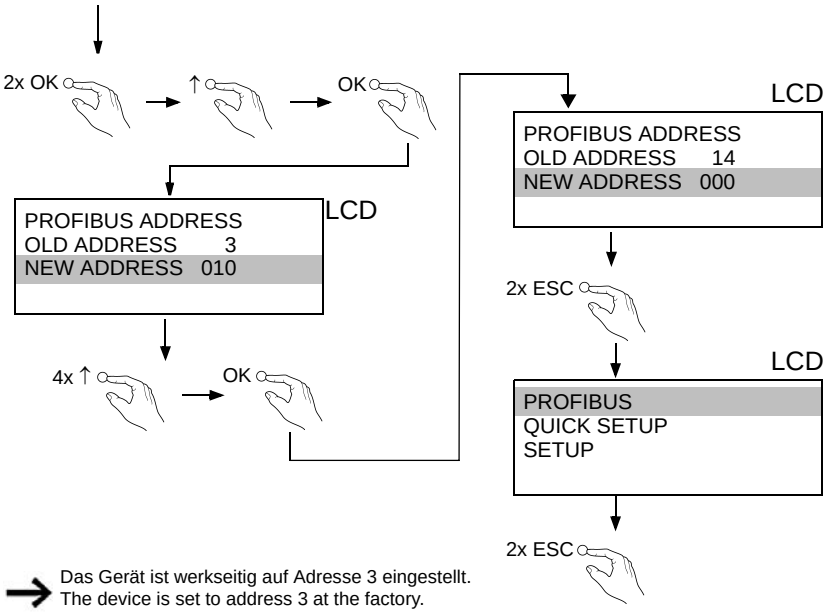
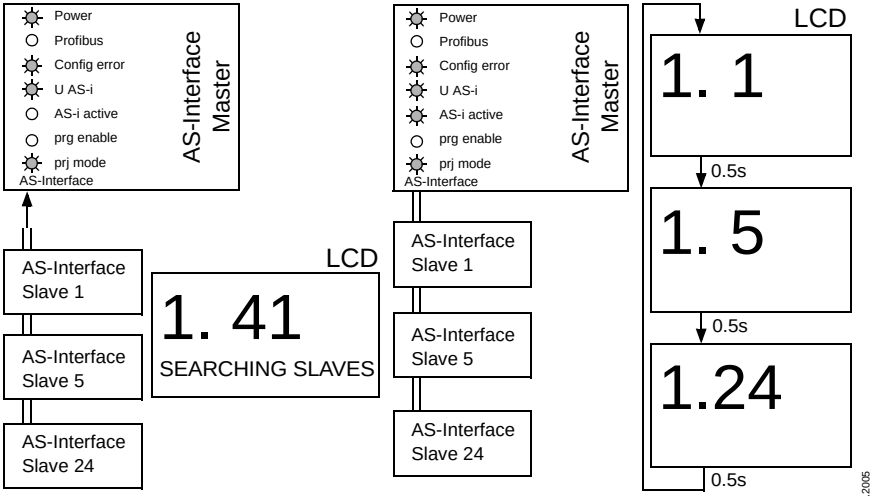


Das Gerät ist werkseitig auf Adresse 3 eingestellt.
The device is set to address 3 at the factory.
L'appareil est réglé en usine à l'adresse 3.
Il dispositivo viene de la fábrica con l'indirizzo 3.
El aparato viene ajustado de fábrica en la dirección 3.

1.3 Connect AS-Interface Slaves



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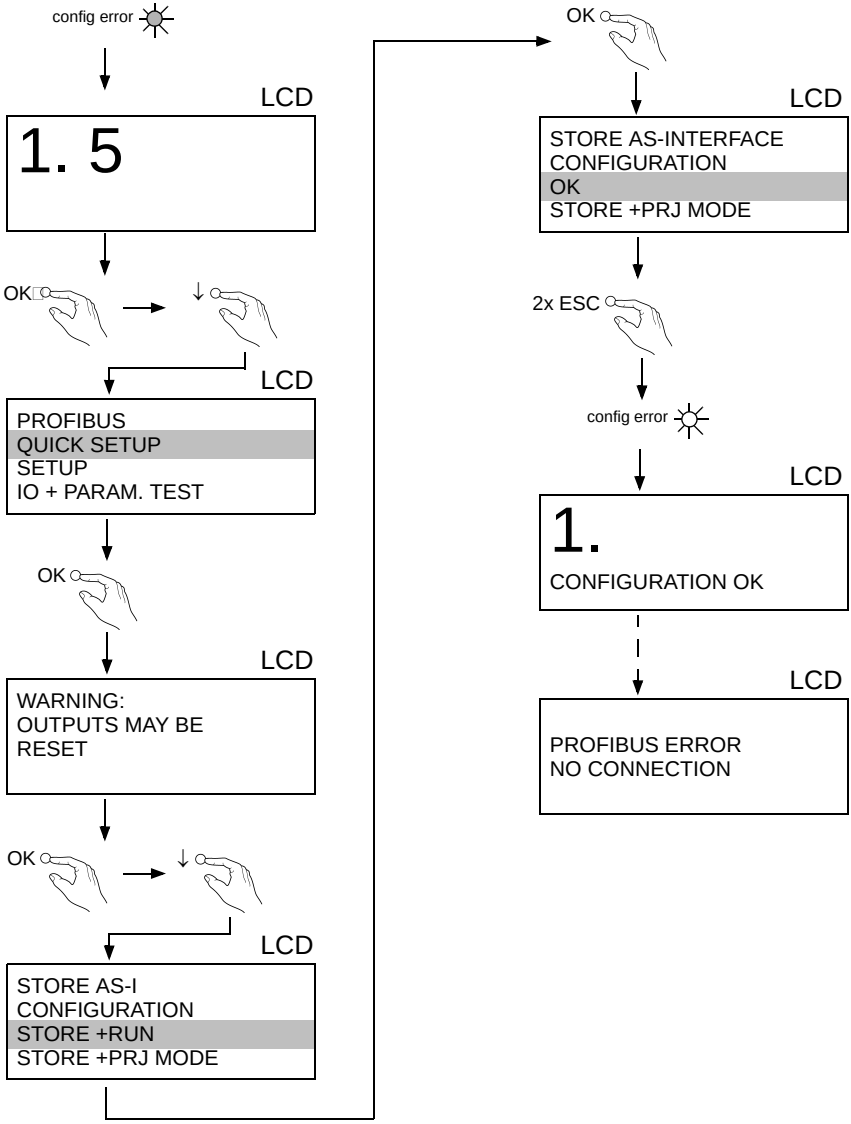
1.4 Quick Setup



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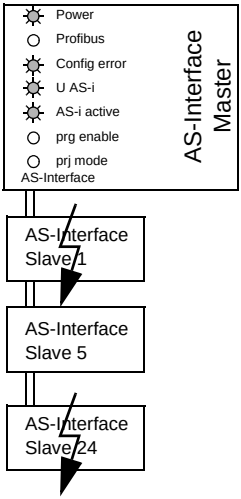
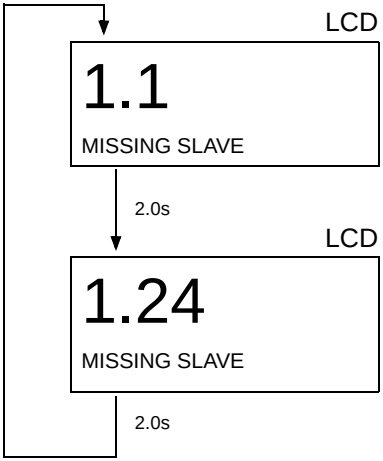
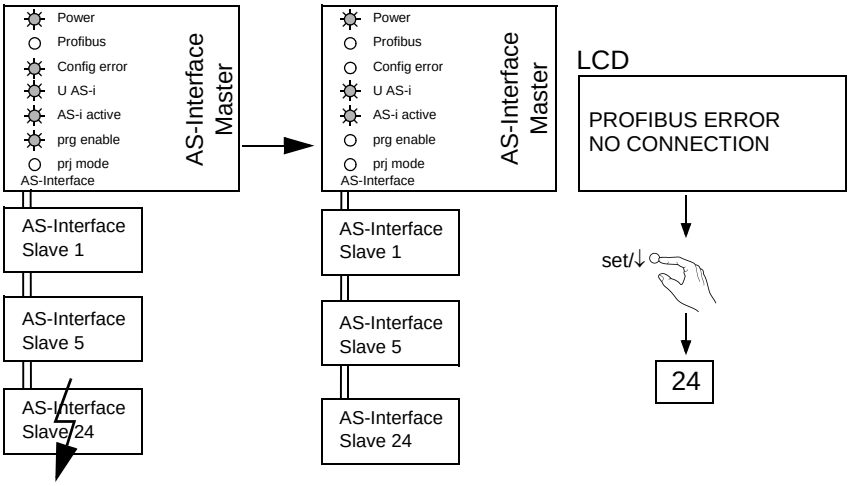
2. Error Tracing

2.1 Incorrect Slaves





2.2 Error Display (Last Error)



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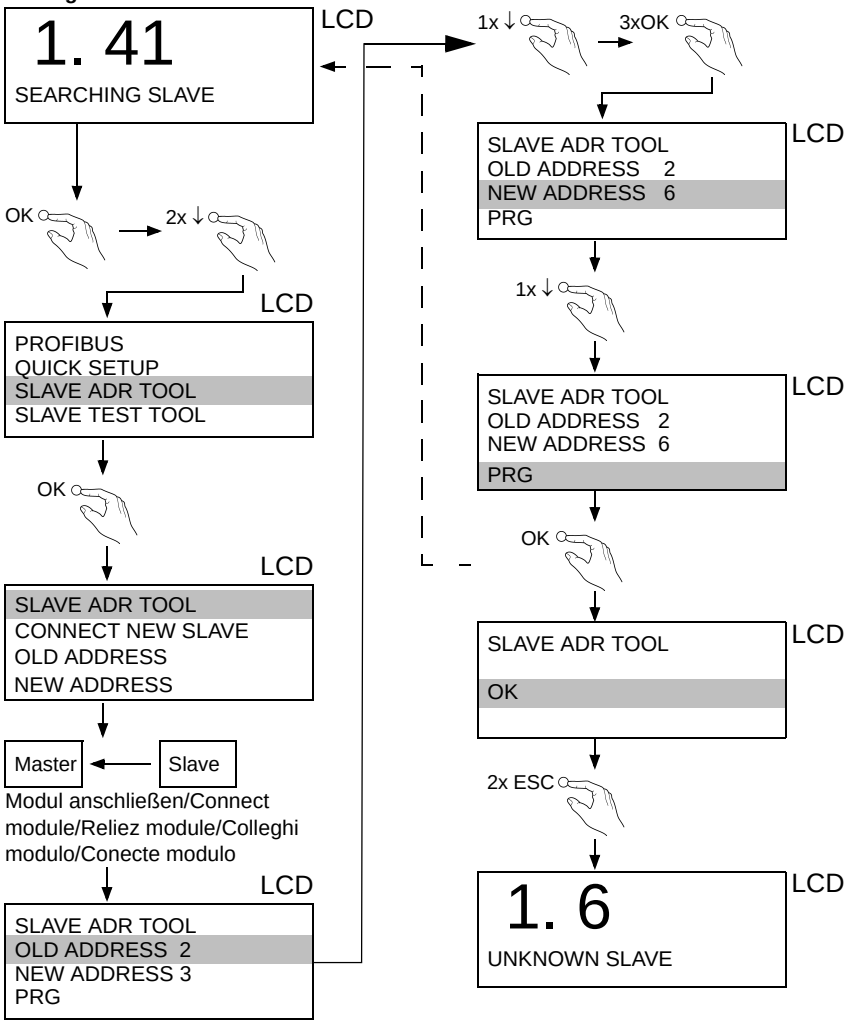
3. Addressing

3.1 Program Slave 2 to Address 6



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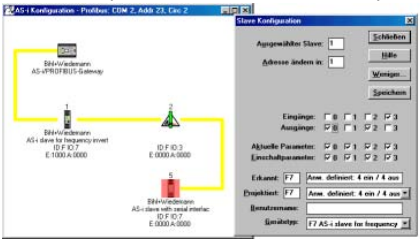
4. Accessories

4.1 Software "AS-i Control Tools" (art. no. 55717), serial transmission cord for AS-i Master in stainless steel (art. no. 556617), serial PROFIBUS Master (art. no. 55716)



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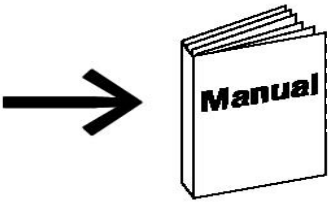
12.2 Installation/Commissioning Instruction AS-i/PROFIBUS Gateway Article Number 556616

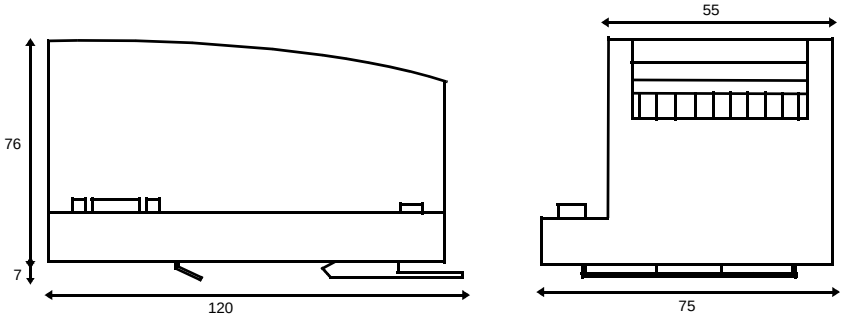
AS-i/PROFIBUS Gateway in Stainless Steel Art. No. 556616



Dokumentation AS-Interface/PROFIBUS-Gateways (**deutsch**) **556615**

Documentation AS-Interface/PROFIBUS-Gateways (**english**) **556615**

Dimensions [mm]



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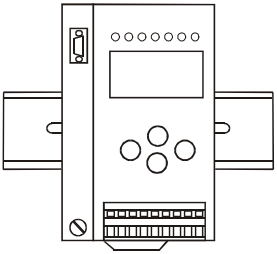
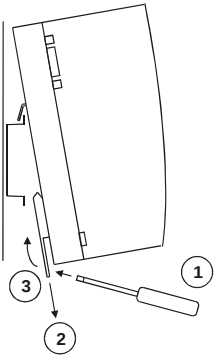
Montage

on mounting plate with 35 mm top-hat rail ①





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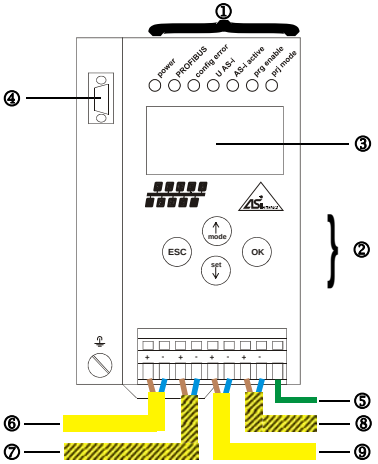
Front View and Connections



⑥ AS-i-Kreis 1/AS-i circuit 1/Bus AS-i 1/AS-i Circuito 1/AS-i Circuito 1

⑦ AS-i-Netzteil Kreis 1/AS-i power supply circuit 1/Alimentation bus AS-i 1/Alimentazione AS-i circuito 1/Alimentación AS-i circuito 1

⑧ AS-i-Netzteil Kreis 2/AS-i power supply circuit 2/Alimentation bus AS-i 2/Alimentazione AS-i circuito 2/Alimentación AS-i circuito 1

⑨ AS-i-Kreis 2/AS-i circuit 2/Bus AS-i 2/AS-i Circuito 2/AS-i Circuito 2

Operating temperature: 0°C … +55°C
Tightening torque: 7 pound inches

① LED-Statusanzeige
② Tasten für Handbedienung
③ LCD-Anzeige
④ PROFIBUS-Anschluss
⑤ Erde
⑦⑧ Stromversorgung
⑥⑨ AS-Interface-Anschluss

① LED status display
② Buttons for hand operation
③ LCD display
④ PROFIBUS connection
⑤ Earth
⑦⑧ Power supply f
⑥⑨ AS-interface connection

① Afficheur d'état DEL
② Boutons pour commande manuelle
③ Afficheur LCD
④ Raccordement PROFIBUS
⑤ Terre
⑦⑧ Alimentation
⑥⑨ Connexion AS-Interface

Hinweis/Hint/Remarque/Indicazione/Nota

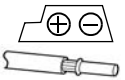
AS-i-Kreis 1 und 2 werden aus seperaten Netzteilen versorgt. Am Kabel für das Netzteil dürfen keine Slaves oder Repeater angeschlossen werden.
Am Kabel für den AS-i-Anschluss dürfen keine AS-i-Netzteile oder weitere Master angeschlossen werden.

AS i circle 1 and 2 are supplied from different power supplies. At the cable for power supply no slaves or repeaters may be attached.
At the cable for AS-i circuit no power supplies or further masters may be attached.

Le bus AS-i 1 et 2 sont fournis à partir de différentes alimentations.
Au câble pour l'alimentation aucun esclave ou répéteur peut ne pas être attaché.
Au câble pour le circuit AS-i aucune alimentation ou autre maître ne peut être attachée

I circuiti AS-i 1 e 2 sono forniti dai gruppi di alimentazione differenti.
Al cavo per il alimentazione nessun schiavi o ripetitore possono essere fissati.
Al cavo per il AS-i circuito nessun alimentazione o ulteriore padrone possono essere fissati.

El AS-i circuito 1 y 2 se provee de diversas fuentes de alimentación.
En el cable para l´alimentación ningunos esclavos o repetidores pueden ser unidos.
En el cable para el AS-i circuito ningunas alimentación u otros amos pueden ser unidos.



Temperature rating for cable: 60/75°C
Use copper conductors only

1 x 0.5 - 1.5 mm² (16AWG)

① Visualizzazione a LED
② Pulsanti per le impostazioni manuali
③ Indicazione LCD
④ Collegamento PROFIBUS
⑤ Terra
⑦⑧ Alimentazione
⑥⑨ Collegamento interfaccia AS-Interface

① LED visualización
② Teclas para accionamiento manual
③ Indicación LCD
④ Conexión PROFIBUS
⑤ Tierra
⑦⑧ Alimentación eléctrica
⑥⑨ Conexión AS-Interface

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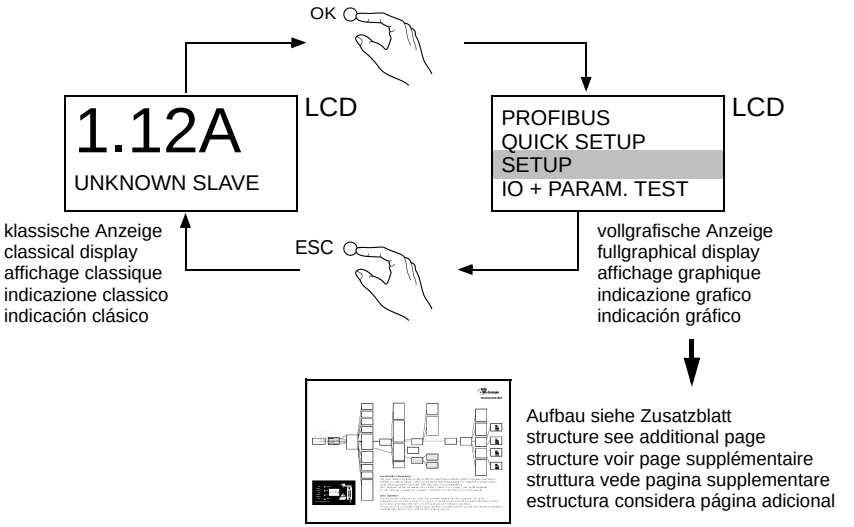
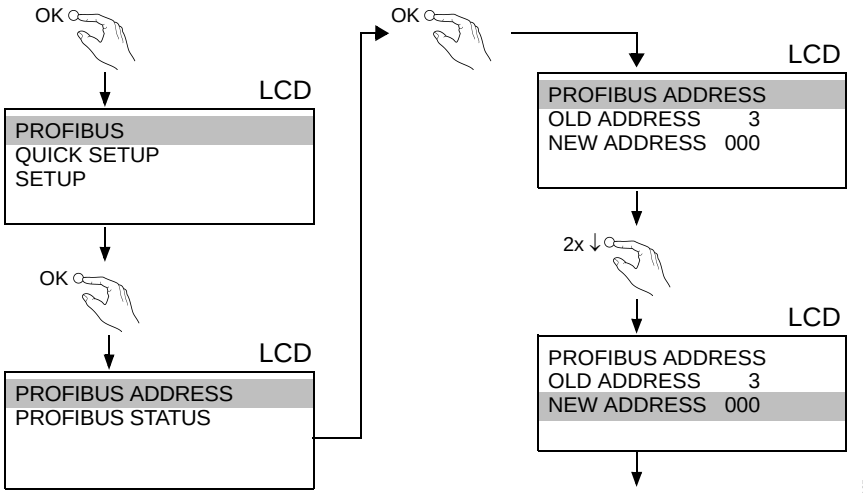
1. Startup

1.1 Fullgraphical Display



1.2 Setting the PROFIBUS DP Address



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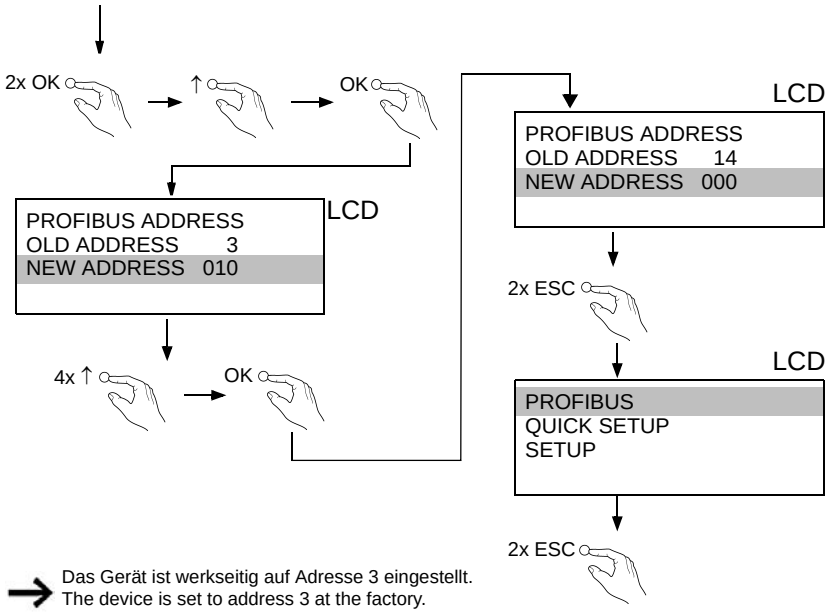
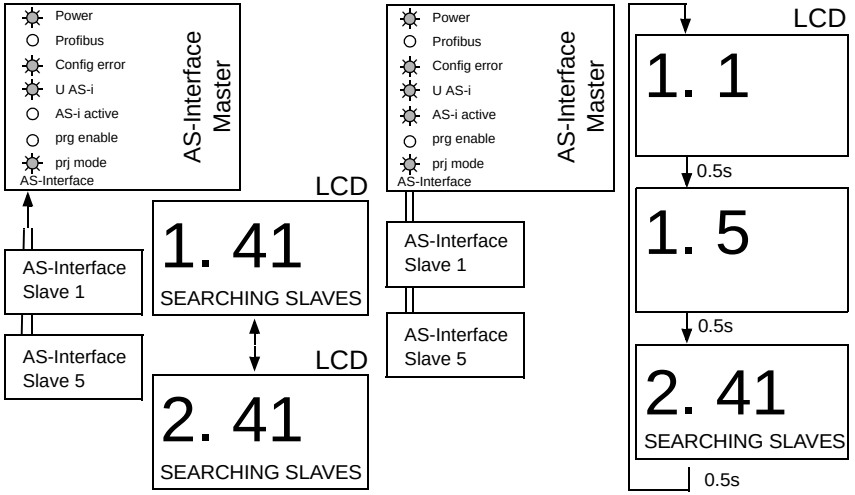


Das Gerät ist werkseitig auf Adresse 3 eingestellt.
The device is set to address 3 at the factory.
L'appareil est réglé en usine à l'adresse 3.
Il dispositivo viene de la fábrica con l'indirizzo 3.
El aparato viene ajustado de fábrica en la dirección 3.

1.3 Connect AS-Interface Slaves



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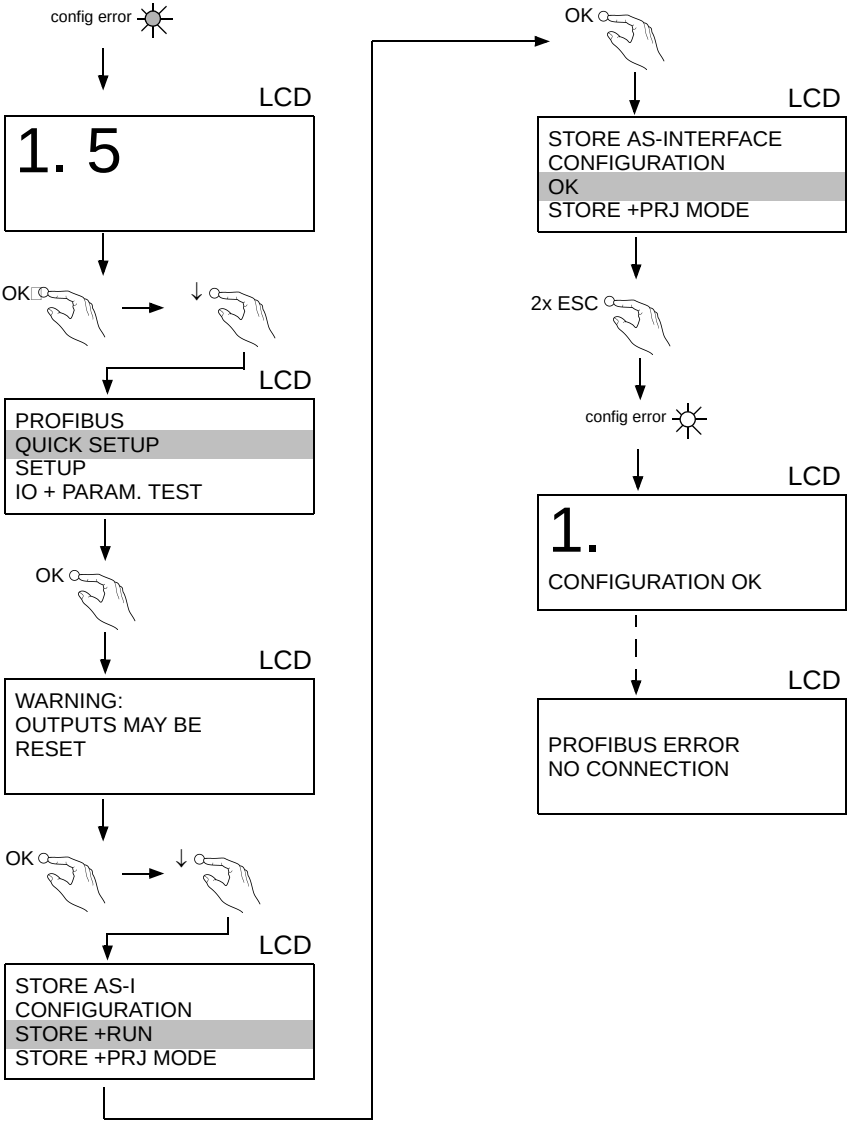
1.4 Quick Setup



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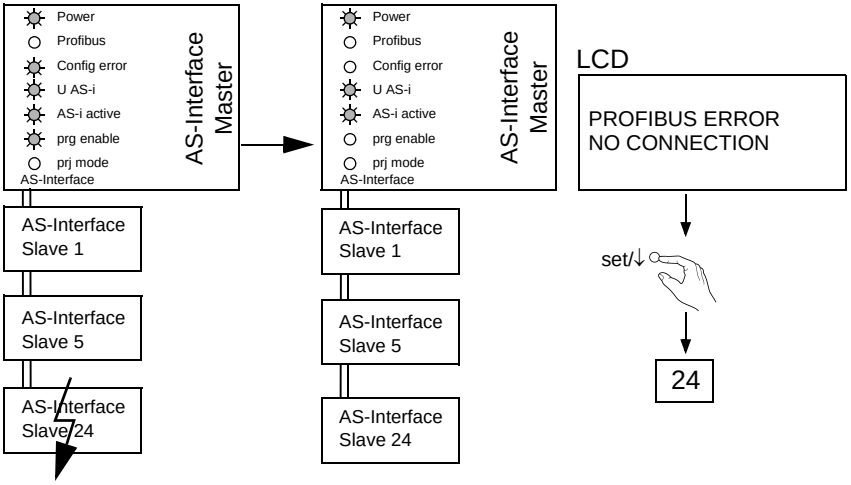
2. Error Tracing

2.1 Incorrect Slaves

2.2 Error Display (Last Error)



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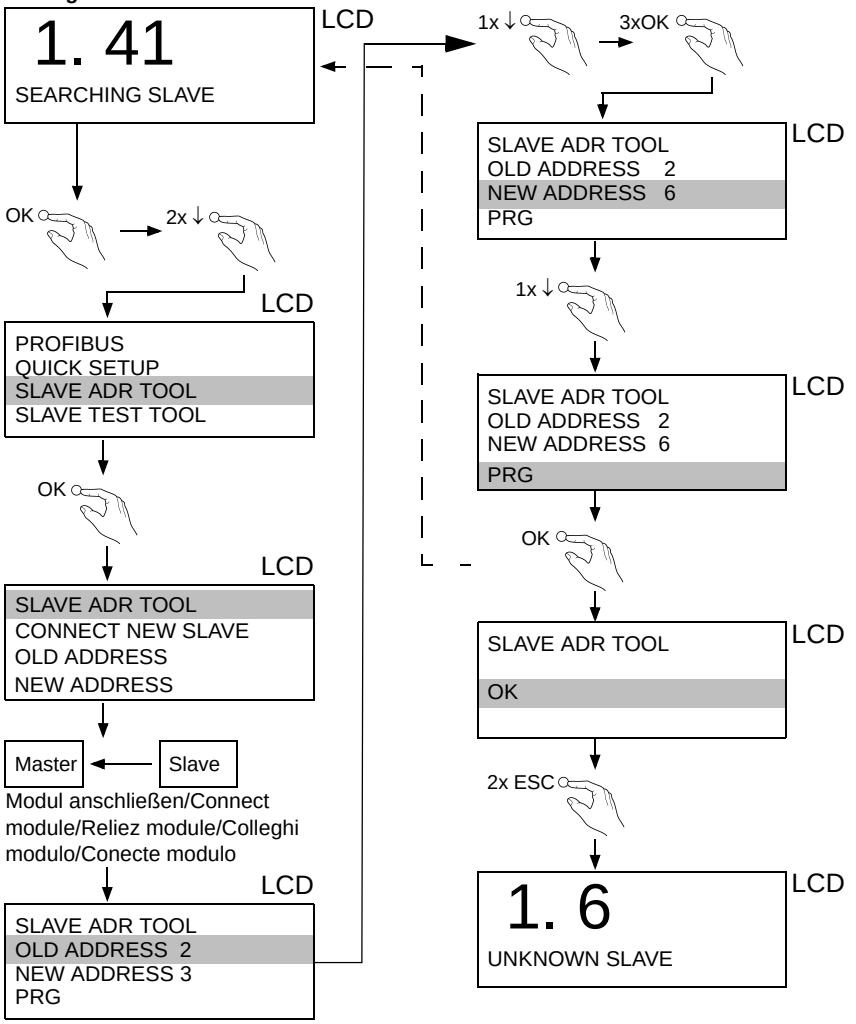
3. Addressing

3.1 Program Slave 2 to Address 6



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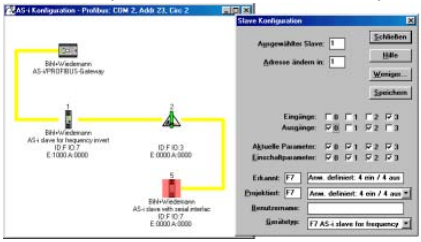
4. Accessories

4.1 Software "AS-i Control Tools" (art. no. 55717), serial transmission cord for AS-i Master in stainless steel (art. no. 556617), serial PROFIBUS Master (art. no. 55716)



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13 Glossary: AS-Interface Terms

A/B slave

AS-Interface slave with extensible addressing: The address range of an A/B slave runs from 1A to 31A and from 1B to 31B. As the master needs the fourth output data bit for switching between A and B address, A/B slaves only have three output data bits maximum.

Activation Phase

In the activation phase the detected slaves are activated by sending the parameter. This is indicated by a "42" on the Master's Display. This phase takes only 10 ms, tops, to short to be displayed.

AS-i power fail

Voltage drop on the AS-i line; by falling below an assigned value the master changes to the ⇒ *Off-line phase*.

Inclusion Phase

After the data exchange with all AS-i slaves the master is searching for new slaves. For this purpose an detection telegram is sent to one AS-i address and in case of an answer the master tries to read the ⇒ *actual configuration* of the slave. Depending on the mode (⇒ *protected mode* or ⇒ *configuration mode*) and on the actual configuration the detected slave will be activated.

After each data exchange with all AS-i slaves only one detection telegram is sent to one slave address. So the AS-i cycle is always one telegram longer as expected from the number of activated slaves (⇒ LAS).

Autoprog Flags

Auto Address Enable; flag from the Host to the AS-i Master
With this flag, automatic addressing can be enabled or inhibited.
This flag is stored non-volatile in the Master.

Auto Address Assign, Auto Adress Possible; flag from the AS-i Master to the Host
The automatic programming is not inhibited and there is no configuration error.
A failing slave could be addressed automatically.

Auto Address Available, flag from the AS-i Master to the Host
Exactly one AS-i slave is missing and the automatic programming is not inhibited. If a slave with the address 0 and the profile of the missing slave is connected, it receives the address of the missing slave automatically.

IO-Code

The first digit of the slave profile indicates the number of inputs and outputs of the slave. A 4I/4O slave e.g. is associated to "7", a slave with 4 digital Inputs to "0".

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Detection phase

In the detection phase at start-up the master is scanning for AS-i slaves. It remains in this phase until at least one slave is detected. If the master remains in the detection phase this means that no slave was found. The reason for this may be a wrong power supply or a wiring error.

The detection phase is displayed by code "41".

Protected mode

In protected mode only those slaves are activated which are registered in the ⇒ *LPS* and whose actual configuration matches with the target configuration.

See ⇒ *configuration mode*. This mode is intended for the normal operation, since all AS-i protective measures are activated.

ID code

The ID code is unchangeably set by the manufacturer of the AS-i slave. The AS-i Association defines the ID codes assigned to a certain category of slaves. All ⇒ *A/B slaves* e.g. possess the ID code "A".

ID1 code, extended ID1 code

The ID1 code is specified by the manufacturer of the slave. In contrast to the other codes defining the profile this code can be modified by the master or by an addressing unit. The user should make use of this possibility only in exeptional cases, otherwise ⇒ *configuration errors* may occur.

To make the distinction between the A and the B addresses in the case of A/B slaves, the bit with the highest value of the ID1 code is used. That is why only the three lowest bits are relevant for these slaves. Since this code has been introduced with the new AS-i specification 2.1, it is also called extended ID1 code.

ID2 code, extended ID2 code

The ID2 code is unchangeably set by the manufacturer of the slave. The AS-i Association defines the ID2 codes assigned to a certain category of slaves. All two-channel analog input slaves with the profile S-7.3 possess the ID2 code "D". Since this code has been introduced with the new AS-i specification 2.1, it is also called extended ID2 code.

Actual configuration

The configuration data of all slaves detected by the master. The configuration data of one slave, the ⇒ *slave profile*, consists of:

⇒ *IO code*, ⇒ *ID code*, ⇒ *extended ID1code 1*, ⇒ *extended ID2 code*.

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Actual parameter

The AS-i parameter that have been sent last to the AS-i slave, in contrary to ⇒ permanent parameters.

Configuration Error/Config Error

An configuration error is indicated, when target and actual configuration of the connected slaves do not match. The following cases may result in configuration errors:

Missing slave: A slave entered in the ⇒ *LPS* is not available

Erroneous type of slave: The ⇒ *slave profile* of the connected slave does not comply with the configured one.

Unknown slave: A connected slave is not entered in the ⇒ *LPS*.

LAS - List of Activated Slaves

The master exchanges IO data with the slaves entered in the LAS. In the proteced mode only those detected slaves (⇒ *LDS*) are activated which are expected by the master and are entered in the ⇒ *LPS*. In the configuration mode all slaves entered in the ⇒ *LDS* are activated.

LDS - List of Detected Slaves

All slaves from which the master was able to read the ⇒ *slave profile* are entered in the LDS.

LPF - List of Peripheral Faults

There is a list of peripheral faults only for masters fulfilling the new specification 2.1. This list includes an entry for each slave that signals a ⇒ *peripheral fault*.

LPS - List of Projected Slaves

The list of projected slaves includes all slaves expected by the master. All entries of the ⇒ *LDS* are taken over to the LPS by storing the actual configuration (except for a not addressed slave with the address 0).

Offline phase

In the offline phase all input and output data is reset. This phase is entered at start-up of the master, after a ⇒ *AS-i power fail*, and at the transition of the ⇒ *configuration mode* to the ⇒ *protected mode*.

Furthermore the master can actively be put into the offline phase with the offline flag.

During the offline phase, masters with a display show code "40".

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Peripheral fault

A peripheral fault is shown on the master and on the slave by a red flashing LED.

Depending on the slave type it is possible to visualize an overflow, an overload of the sensor's power supply or another fault regarding the peripheral equipment of the slave.

Permanent configuration

The configuration data of all expected slaves stored in the master (⇒ *slave profile*). If the permanent configuration differs from the ⇒ *actual configuration*, there is a configuration error.

Permanent parameter

The parameter stored in the master that are sent to the slave after start-up of the master in the ⇒ *activation phase*.

Configuration mode

During the configuration mode the master exchanges data with all connected slaves, no matter which of the slaves are projected. In this mode it is possible to commission a system without being obliged to configure it before.

See also ⇒ *protected mode*.

Single slave

Compared to an ⇒ *A/B slave* a single slave can only be addressed from the address 1 to 31; the fourth data output bit can be used. All slaves of the older specification 2.0 are single slaves.

There are also slaves fulfilling the new specification 2.1 that are single slaves, e.g. the newer analog slaves.

Slave profil

The configuration data of a slave consisting of:

⇒ *IO code*, ⇒ *ID code*, ⇒ *extended ID1 code*, ⇒ *extended ID2 code*.

The slave profile is to differentiate between the different slave categories. It is specified by the AS-i Association and preset by the slave manufacturer.

AS-Interface 2.0 slaves do not have extended ID1 and ID2 codes. In this case an AS-Interface master 2.1 enters "F" the extended ID1 and the extended ID2 code.

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